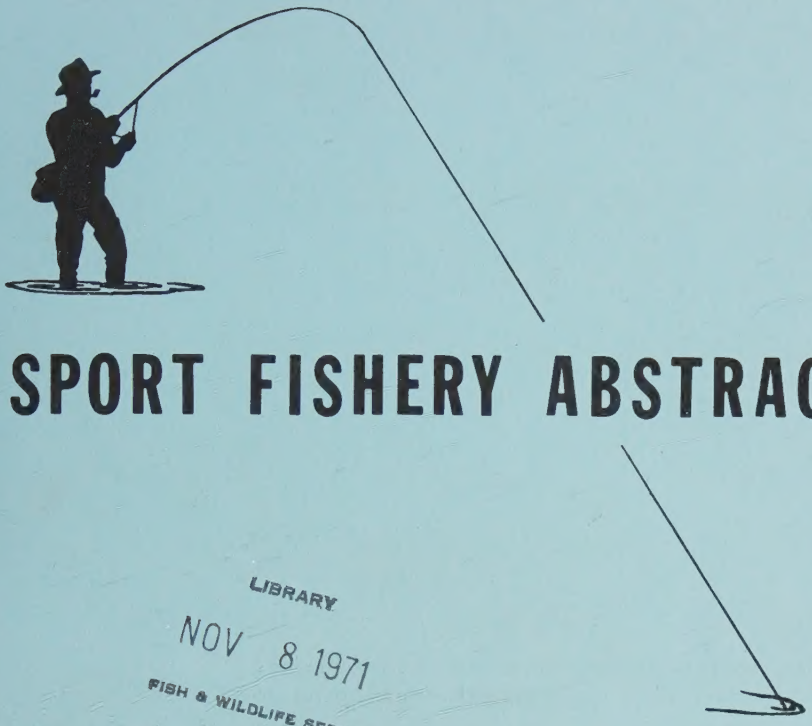
16(2)
16(2)



SPORT FISHERY ABSTRACTS

LIBRARY
NOV 8 1971
FISH & WILDLIFE SERVICE

Vol. 16, No. 2, 1971

Abstracts 13115 - 13472

DEPARTMENT OF THE INTERIOR
U. S. FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

DEPARTMENT OF THE INTERIOR

U. S. FISH AND WILDLIFE SERVICE

BUREAU OF SPORT FISHERIES AND WILDLIFE

Use of funds for printing this publication approved by the Director of the Office of Management and Budget November 1970

Prepared in the Division of Fishery Research

Narragansett, Rhode Island

SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Vol. 16, No. 2 Abstracts 13115-13472 1971

Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

One volume consisting of four numbers is issued each year. Each number contains separate Author and Subject indexes. The final number of each volume contains cumulative Author and Subject indexes and a list of publications screened.

Suggestions for improving the usefulness and scope of Sport Fishery Abstracts are solicited.

The Bureau of Sport Fisheries and Wildlife of the U. S. Fish and Wildlife Service assumes no responsibility for the accuracy of material from outside sources, and can only supply copies of articles written and published by the U. S. Fish and Wildlife Service. Requests for other articles should be sent to the author or publisher.

Robert M. Howland, Editor
Gertrude Kavanagh, Asst. Editor

Authors who believe their publications should be included in Sport Fishery Abstracts are asked to submit abstracts to:

Editor, Sport Fishery Abstracts
Bureau of Sport Fisheries and Wildlife
Narragansett Bay Campus of the
University of Rhode Island
Narragansett, Rhode Island 02882

Translations done in the Division of Fishery Research, Bureau of Sport Fisheries and Wildlife are available only on loan for reproduction, due to the limited number of copies.

13115. Iles, Christine (Fish. Res. Bd. Canada, Biol. Station, St. Andrews, New Brunswick, Canada). 1971. Fistulicola plicatus (CESTODA) AND Tristoma spp. (TREMATODA) ON SWORDFISH FROM THE NORTHWEST ATLANTIC. J. Fish. Res. Bd. Canada, 28(1): 31-34.

Data on the incidence, location, and morphology of the scolex of Fistulicola plicatus in 24 specimens of swordfish (Xiphias gladius) from the northwest Atlantic are given. The occurrence of normal scolices in tubular sheaths or bladderlike cysts on the outer surface of the rectum is recorded for the first time for this species. The incidence and location on the gills of Tristoma coccineum and T. integrum are given and the possibility of using these monogenetic trematodes as biological tags is discussed. The increase in the number of dorsomarginal rows of comb teeth with body length for immature specimens of T. coccineum is demonstrated. (Auth.)

13116. Spence, J. A., and H. B. N. Hynes (Dept. of Biology, Univ. of Waterloo, Waterloo, Ontario, Canada). 1971. DIFFERENCES IN BENTHOS UPSTREAM AND DOWNSTREAM OF AN IMPOUNDMENT. J. Fish. Res. Bd. Canada, 28(1): 35-43.

Pronounced differences were found in the macroinvertebrate riffle fauna upstream and downstream of a flood control impoundment. Downstream differences were comparable with those occurring after mild organic enrichment. Plecoptera were absent, but numbers of Baetis and Caenis (Ephemeroptera) increased, and the abundance and number of species of Stenonema were considerably reduced. Numbers of Chironomidae, Simulidae, Optioservus (Coleoptera), Hydropsychidae, and Hyalella azteca (Amphipoda) increased downstream. These changes are associated with downstream increase in the availability of detritus, a lag of about 4 weeks in the early summer rise in water temperature and a maximum temperature more than 6 degrees C lower than upstream, and alteration of other environmental factors. (Authors)

13117. Spence, J. A., and H. B. N. Hynes (Dept. of Biology, Univ. of Waterloo, Waterloo, Ontario, Canada). 1971. DIFFERENCES IN FISH POPULATIONS UPSTREAM AND DOWNSTREAM OF A MAINSTREAM IMPOUNDMENT. J. Fish. Res. Bd. Canada, 28(1): 45-46.

Four species of cyprinid fishes, Hybopsis biguttata, H. micropogon, Pimephales notatus, and Notropis spilopterus found in a river upstream of a flood control dam are absent downstream. With the release downstream of cold hypolimnial waters from the dam there was a lag of about 4 weeks in the spring rise of water temperatures and a maximum summer temperature 7 degrees C lower than upstream. Of the fish present in the river these four species had the most southerly distributions, all south of the 64 F (17.8 C) July isotherm, and it is concluded that the lower water temperatures are mainly responsible for their absence downstream of the dam. (Authors)

13118. Yu, Man-Lim, Charles W. Kiley, Daniel A. Sarot, and Alfred Perlmutter (Lab. of Aquatic Biology, Graduate School of Arts and Sciences, New York Univ., New York, N. Y.). 1971. RELATION OF HEMOSIDERIN TO ERYTHROPOIESIS IN THE BLUE GOURAMI, Trichogaster trichopterus. J. Fish. Res. Bd. Canada, 28(1): 47-48.

The presence of hemosiderin bodies was demonstrated in the spleen, liver, and kidney of the blue gourami, Trichogaster trichopterus, with the spleen as the predominant site of accumulation. Bleeding, which indirectly stimulates erythropoiesis in this fish, reduced the percentage of hemosiderin bodies in experimental fish to a much lower value than was found in normal fish. A possible relation between these hemosiderin bodies and erythropoiesis is discussed. (Authors)

13119. Kennamer, Earl F. (Cooperative Extension Service, Auburn Univ., Auburn, Alabama). 1970. CATFISH IN CAGES. Cooperative Extension Service, Auburn Univ., Auburn, Alabama, Circular E-16, 9 pp., illus.

13120. Sprague, J. B., and J. R. Duffy (Fish. Res. Bd. Canada, Biological Sta., St. Andrews, New Brunswick, Canada). 1971. DDT RESIDUES IN CANADIAN ATLANTIC FISHES AND SHELLFISHES IN 1967. J. Fish. Res. Bd. Canada, 28(1): 59-64.

DDT residues were average or less than average in lobsters, five species of molluscan shellfishes, and seven species of finny fishes from estuarial and coastal waters of New Brunswick and Prince Edward Island, compared with the same or similar species elsewhere in North America and northern Europe. Mackerel had the highest residues averaging 0.38 ppm of DDT or 0.54 ppm of DDT plus metabolites. These levels do not seem to be an immediate danger to the fish. In terms of human diet, residues in mackerel are as high as those in some beef. The other species averaged 0.1 ppm or less of total DDT residue in the whole body or muscle, usually much less. This is relatively low by present day findings. Viscera of salmon, cod, and hake had 6-15 times higher concentrations of DDT residues than did muscle. Flounder viscera had no more residue than did muscle, whereas lobster eggs had nine times as much as muscle. None of the four sampling locations produced consistently higher residues than the others. (Authors)

13121. Sakagawa, Gary T., and Richard L. Pycha (Dept. of Wildlife and Fisheries, The Univ. of Mich., Ann Arbor, Michigan). 1971. POPULATION BIOLOGY OF LAKE TROUT (Salvelinus namaycush) OF LAKE SUPERIOR BEFORE 1950. J. Fish. Res. Bd. Canada, 28(1): 65-71.

Scale samples collected in 1948 were used to estimate the instantaneous total mortality rate (0.70) and growth for lake trout (Salvelinus namaycush) in Lake Superior before the population had been significantly reduced by the sea lamprey (Petromyzon marinus). Indirect evidence indicates that the instantaneous natural mortality rate was probably 0.10-0.25. The Ricker model was used to calculate yield per recruitment, which varied with natural mortality and growth. Natural mortality was more critical than growth; yield per recruitment increased 183.3% with a 60% decrease in instantaneous natural mortality (from 0.25 to 0.10). For the prelamprey lake trout population the yield per recruitment was about 12-34 lb; the recruitment of about 3.6-10.1 million lake trout of age 1.5 resulted in an annual commercial production of 4 million lb. (Authors)

13122. Hildebrand, Stephen G. 1971. THE EFFECT OF COHO SPAWNING ON THE BENTHIC INVERTEBRATES OF THE PLATTE RIVER, BENZIE COUNTY, MICHIGAN. Trans. Amer. Fish. Soc., 100(1): 61-68.

This study was undertaken to determine what effects a spawning run of coho salmon would have on the benthos of the Platte River, Benzie County, Michigan. It was hypothesized that the physical disruption of the substrate, by spawning salmon, would reduce the density of benthos by dislodging the organisms and causing their downstream displacement. Estimates of density of benthic invertebrates were made in two control sections (salmon excluded) and in one experimental section (salmon having free access) in May and August 1967 prior to coho spawning run, and in December 1967 and May 1968 after the run. Coho spawning activity in the fall of 1967 disturbed the bottom materials. The densities of 12 taxa, as well as the total number and total weight of organisms per square foot, decreased significantly in samples collected in December after disruption. The decrease in total number of organisms per square foot in the experimental section as compared to the controls was 270.5; the decrease in weight in the experimental section was 1.97 grams. This is a percent decrease in the experimental section relative to the controls of 66% for total number and 78% for total weight. In May 1968, the number of organisms per square foot was still significantly lower in the experimental section (57.4 per square foot), but weight of organisms per square foot was not. The percent decrease in the experimental section relative to the controls for total number was 39%. Three of twelve taxa, whose density was reduced in the fall of 1967, were still lower in May 1968. Complete recovery of benthos was not observed in the 5-month period from December to May. (Auth.)

13123. MacKelvie, R. M. (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1971. A DEVICE FOR RAPID REMOVAL OF EMBRYOS FROM FISH EGGS. J. Fish. Res. Bd. Canada, 28(1): 100-102.

An inexpensive and easily constructed device is described whereby embryos were removed from fish eggs for the study of viral multiplication. (Auth.)

13124. Reynolds, James B., and Douglas R. McLain (U. S. Fish and Wildlife Service, Great Lakes Fishery Lab., Ann Arbor, Michigan). 1971. PLOTTING OF BATHYTHERMOGRAPH TRANSECT DATA ON A PRINTER. J. Fish. Res. Bd. Canada, 28(1): 102-103.

A program for plotting bathythermograph transect data on a computer (IBM 1130) printer is available from the Great Lakes Fishery Laboratory. Temperature values are printed in positions proportional to their depths and distances from shore. Contour lines are drawn manually through the plotted points. (Authors)

13125. Fredeen, F. J. H., J. G. Saha, and L. M. Royer (Canada Dept. of Agriculture, Research Station, Saskatoon, Saskatchewan, Canada). 1971. RESIDUES OF DDT, DDE, AND DDD IN FISH IN THE SASKATCHEWAN RIVER AFTER USING DDT AS A BLACKFLY LARVICIDE FOR TWENTY YEARS. J. Fish. Res. Bd. Canada, 28(1): 105-109.

Concentrations of organochlorine pesticide residues in the muscle tissues of fish collected from the Saskatchewan River after a 20-year blackfly larviciding program using DDT ranged from less than 0.01-0.05 ppm of DDT, less than 0.01-0.05 ppm DDD (TDE), 0.01-0.06 ppm DDE, and 0.002-0.006 ppm dieldrin. These concentrations are well below the actionable level of 5.0 ppm of DDT residues in edible flesh. Tests with DDT-C^{14} showed that a single extraction of fish tissues with acetonitrile removed about 93% of metabolically incorporated residues. (Authors)

13126. McKone, D. (The Institute of Animal Resource Ecology and Dept. of Zoology, The Univ. of Brit. Columbia, Vancouver 8, Brit. Columbia, Canada). 1971. RATE AT WHICH SOCKEYE SALMON ALEVINS ARE EVACUATED FROM THE STOMACH OF MOUNTAIN WHITEFISH (Prosopium williamsoni). J. Fish. Res. Bd. Canada, 28(1): 110-111.

When adult mountain whitefish (Prosopium williamsoni) were force-fed two, five, or eight sockeye salmon (Oncorhynchus nerka) alevins in aquaria during May and June, 1969, examination of the stomachs showed that the evacuation rate was 9.8-17.8% per hour, and was greater at higher than lower temperatures. Absolute rate of disappearance (grams/hour) was more rapid at higher than at lower temperatures and for larger than smaller food volumes. The evacuation rate was rapid and required only 6 hr at 11 C for complete evacuation of two alevins. (Auth.)

13127. Smith, C. E. (U. S. Fish and Wildlife Service, Fish Cultural Development Center, Bozeman, Montana). 1971. AN UNDIFFERENTIATED HEMATOPOIETIC NEOPLASM WITH HISTOLOGIC MANIFESTATIONS OF LEUKEMIA IN A CUTTHROAT TROUT (Salmo clarki). J. Fish. Res. Bd. Canada, 28(1): 112-113.

An undifferentiated hematopoietic neoplasm was diagnosed in a 2-year-old cutthroat trout (Salmo clarki). Malignant tumor cells had invaded spleen, kidney, and liver tissue. These same cells were found circulating freely in peripheral blood suggesting leukemia. (Auth.)

13128. Luhning, Charles W., and Paul D. Harman (Bur. of Sport Fisheries and Wildlife, Southeastern Fish Control Lab., Warm Springs, Georgia). 1971. SAMPLING OF FISH MUSCLE FOR M.S. 222 AND QUINALDINE RESIDUES. J. Fish. Res. Bd. Canada, 28(1): 113-115.

Large variations in concentrations of M.S. 222 (tricaine methanesulfonate) and quinaldine (2-methylquinoline) residues occurred in various areas of fish fillets. Residue analyses of replicate samples from homogenized fillets yielded more representative results than samples cut from various areas of fillets. (Authors)

13129. McCart, P., and P. Craig (Dept. of Biology, Univ. of Saskatchewan, Regina Campus, Regina, Saskatchewan, Canada). 1971. MERISTIC DIFFERENCES BETWEEN ANADROMOUS AND FRESHWATER-RESIDENT ARCTIC CHAR (Salvelinus alpinus) IN THE SAGAVANIRKTOK RIVER DRAINAGE, ALASKA. J. Fish. Res. Bd. Canada, 28(1): 115-118.

Both anadromous and freshwater-resident populations of Arctic char (Salvelinus alpinus) occur in the Sagavanirktok River drainage, Alaska. A comparison of the gill-raker and pyloric-caeca counts of populations of the two types revealed that anadromous fish had lower gill-raker and pyloric-caeca counts than freshwater-resident fish. Freshwater-resident populations correspond meristically to McPhail's Eastern Arctic form, and anadromous populations correspond to his Western Arctic-Bering Sea form. It is suggested that the former was the original inhabitant of the area but has been replaced by the latter except in inaccessible, headwater lakes. (Authors)

13130. Lennon, Robert E., Joseph B. Hunn, Rosalie A. Schnick, and Ralph M. Burress (Fish Control Laboratory, La Crosse, Wisconsin). 1970. RECLAMATION OF PONDS, LAKES, AND STREAMS WITH FISH TOXICANTS: A REVIEW. FAO of the United Nations, FAO Fisheries Technical Paper No. 100, December, 1970.

The Food and Agriculture Organization of the United Nations commissioned the U. S. Bureau of Sport Fisheries and Wildlife to prepare a review of literature on the reclamation of ponds, lakes, and streams with fish toxicants. Total or partial reclamation of small ponds, especially fish production ponds, with general or selective toxicants is a very common practice. The eradication of undesirable fishes from public lakes and streams began over 60 years ago, but accelerated within the past two decades as wild waters increasingly required fish management and as improved toxicants became available. Toxicants such as the organochlorines and organophosphates, borrowed from agriculture, are being replaced with controls that are more specific to fish or more appropriately formulated for aquatic application. Formulations of rotenone and antimycin are the most used, general fish toxicants in the United States; TFM is a successful, selective toxicant for larval sea lampreys in tributaries to the Great Lakes; and Squoxin is in advanced stages of development as a selective toxicant for squawfishes in salmonid streams on the west coast of North America. The review of literature and a widely circulated questionnaire indicate that 27 countries, in addition to the United States, and Canada, have used or are using fish toxicants for the control of undesirable fishes. Indicated, too, is the need for much research on all aspects of reclamation -- on the biology of target fishes; on alternatives to chemical control; on safe, effective, and non-persistent toxicants; on formulations and dispensing apparatus to reach and kill target fishes with the least possible contamination of the environment; on controls that may be integrated with toxicants to enhance reclamations; and on methods and equipment for pre- and post-treatment surveys and evaluations. (Authors)

13131. Polisini, J. M., Claude E. Boyd, and Bonny Didgeon (Savannah River Ecology Laboratory, Aiken, South Carolina). 1970. NUTRIENT LIMITING FACTORS IN AN OLIGOTROPHIC SOUTH CAROLINA POND. Oikos, 21(2): 344-347, Copenhagen.

Nutrient relationships were studied in a small oligotrophic pond. Dissolved nutrient levels were very low and marked seasonal changes in concentrations were not apparent. Rainfall nutrient input was large, but comparatively small quantities of nutrients entered the pond in leaf fall. Light and dark bottle productivity estimates were very low. The carbon-14 bioassay technique revealed that sulfate was the only single nutrient capable of increasing productivity. Combinations of nitrate and phosphate increased productivity as much as nitrate, phosphate, and sulfate. When calcium or potassium was added with these anions an additional increase in carbon-14 uptake was observed. (Authors)

13132. Khoroshko, P. N., and A. D. Vlasenko (Central Research Inst. of the Sturgeon Fisheries (TsNIORKh), Astrakhan', USSR). 1970. ARTIFICIAL SPAWNING GROUNDS OF STURGEON. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 286-292.

The improvement of existing spawning grounds for sturgeon and the creation of artificial spawning grounds is a question which is coming to be of extreme urgency in view of the increased amount of hydraulic engineering work. Three experimental stone-gravel spawning grounds were constructed for the first time in 1966 on the Volga in the area of the village of Tsagan-Aman and on the Kuban' in the afterbay of the Fedorovka hydroelectric power station undertaking. Two years of observations on the conditions of exploitation of the artificially created spawning grounds have revealed the nature of their utilization by anadromous fishes. Recommendations on extension of the spawning area of sturgeon have been worked out on the basis of an analysis of the material collected.

13133. Moiseyeva, Ye. B. (Azov-Black Sea Research Inst. for Sea Fisheries and Oceanography, Kerch, USSR). 1970. A MORPHOPHYSIOLOGICAL STUDY OF THE PITUITARY GLAND OF THE TOAD GOBY (Gobius batrachocephalus Pall.) IN RELATION TO THE REPRODUCTIVE CYCLE. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 293-303.

The pituitary gland of the toad goby consists of four clearly distinguishable regions: pro-adenohypophysis, meso-adenohypophysis, meta-adenohypophysis and neurohypophysis made up of six main types of cells. The gonadotropic and thyrotropic elements are represented by the basophil cells of the meso-adenohypophysis, which have a distinct PAS-positive and Gomori-positive reaction. Comparison of sexually immature and sexually mature fishes has shown that the thyrotropic elements are located near the pro-adenohypophysis at the boundary of the meso-adenohypophysis and the neurohypophysis. The gonadotropic elements are 'dark' and 'light' basophil cells located in the median and peripheral zones of the meso-adenohypophysis and embracing the region of the meta-adenohypophysis in a broad band. During the period of maturing of the gonads and spawning the zone of gonadotropic elements in the pituitary gland is enlarged and signs of their active functioning appear. These are expressed in the appearance, accumulation and secretion from the cell cytoplasm of Gomori-positive and PAS-positive granules, and also in the destruction of part of the glandular components and their conversion to a basophilic secretion. In the post-spawning period the mass depletion of the glandular cells to be noted in the different zones of the adenohypophysis justifies the assumption that a part is played in the processes of reproduction by an entire group of hormonal factors probably functioning in combination.

13134. Dekhnik, T. V., L. A. Duka, and V. I. Sinyukova (Inst. of the Biology of the Southern Seas, Ukrainian Acad. of Sciences, Sevastopol', USSR). 1970. FOOD SUPPLY AND THE CAUSES OF MORTALITY AMONG THE LARVAE OF SOME COMMON BLACK SEA FISHES. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 304-310.

The food supply and causes of mortality among the larvae of some common Black Sea fishes are considered from three points of view: 1) alteration in abundance, survival and mortality of eggs and larvae; 2) the food of fish larvae and their trophic interrelationships; 3) the nature of the link "predator - larva - food".

13135. Mel'nikova, M. N. (Lab. of Diadromous Fishes, State Research Inst. for Lake and River Fisheries (GosNIORKh), Leningrad, USSR). 1970. SOME FEATURES OF YOUNG ATLANTIC SALMON (Salmo salar L.) IN SEVERAL RIVERS IN THE WHITE SEA BASIN. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 311-319.

Data are given on the downstream migration, age composition and growth of young Atlantic salmon from various rivers in the White Sea Basin.

13136. Kennamer, Earl Franklin (Cooperative Extension Service, Auburn Univ., Auburn, Alabama). 1970. CATFISH FOR FUN AND CASH. Cooperative Extension Service, Auburn Univ., Auburn, Alabama, Circular E-15, 35 pp., illus.

13137. Khashem, M. T. (Faculty of Ichthyology, Moscow State Univ. and Darwin State Reservation, USSR). 1970. CONDITION AND FATNESS OF THE BLUE BREAM [Abramis ballerus (L.)] IN RYBINSK RESERVOIR. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 320-327.

An examination is made of the seasonal dynamics of the condition and fatness of the blue bream and of the connection between these characteristics and sexual maturation. Condition and fatness are compared with the same characteristics in past years.

13138. Chikova, V. M. (Kuibyshev Station of the Inst. of the Biology of Inland Waters, USSR Acad. of Sciences, Togliatti, USSR). 1970. THE FEEDING OF THE PERCH [Perca fluviatilis (L.)] IN THE DRAWN-DOWN ZONE OF KUIBYSHEV RESERVOIR AROUND THE DAM. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 328-332.

A study has been made of the feeding of the perch in connection with the special features of the development of food resources in a drawn-down zone, and of the seasonal dynamics of feeding and alteration in the composition of the food with the growth of the perch. Consideration is given to the food interrelationships between the perch and other fish species using the same zone for feeding.

13139. Krivobok, M. N., and O. I. Tarkovskaya (All-Union Research Inst. for Sea Fisheries and Oceanography (VNIRO), Moscow, USSR). 1970. SOME FEATURES OF THE METABOLISM OF THE STURGEON AND THE SEVRYUGA IN EARLY DEVELOPMENTAL STAGES. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 333-337.

The paper presents data on the biochemical composition of sturgeon and sevryuga eggs and larvae in the early developmental stages.

13140. Ostroumova, I. N. (State Research Inst. for Lake and River Fisheries (GosNIORKh), Leningrad, USSR). 1970. PROTEIN COMPOSITION OF THE BLOOD SERUM OF THE CASPIAN SALMON IN CONNECTION WITH ITS TAXONOMIC POSITION. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 338-341.

Horizontal paper electrophoresis has been performed on the blood serum proteins of the Caspian (Terek) and Baltic salmon, the Atlantic salmon and the Baltic anadromous brown trout and resident brown trout. It has been established that the distribution pattern of the protein fractions on phoregrams of the Caspian salmon is in complete agreement with the distribution pattern for the sea trout and the river trout (Salmo trutta) and differs from the protein spectrum of salmon (S. salar). On this basis the author supports the point of view of those authors who ascribe the Caspian salmon to the species Salmo trutta L.

13141. Timoshina, L. A. (Lab. of the Physiology of Fishes, State Research Inst. for Lake and River Fisheries, Leningrad, USSR). 1970. CHANGES BROUGHT ABOUT IN THE AMINO ACID COMPOSITION OF FISH MUSCLES AND BLOOD BY STARVATION. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 342-347.

Combined and free amino acids in carp, catfish, tench and pike muscles during the period of winter starvation were determined by paper chromatography. No significant alterations were found in the set of amino acids or in the proportionate relationship of amino acids in muscle protein. Twenty free amino acids were identified in the muscles of these fishes. After the winter starvation of the fishes the concentration of most amino acids was reduced, with the exception of sarcosine and threonine in the carp and threonine in the pike. The blood serum of the rainbow trout was found to contain 18 free and 17 combined amino acids. After a month of summer starvation of the fishes combined amino acids were not significantly altered but the concentration of free amino acids was perceptibly increased.

13142. Mailyan, R. A. (Azerbaydzhanian Dept., Central Sturgeon Fisheries Research Inst., TsNIORKh, USSR). 1970. FACTORS LIMITING THE ABUNDANCE OF FISHES. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 394-399.

13143. Tugarina, P. Ya., and L. N. Ryzhova (Faculty of Vertebrate Zoology, Irkutsk State Univ., USSR). 1970. AGE-RELATED FEATURES OF THE BLOOD OF THE 'BLACK' BAIKAL GRAYLING (Thymallus arcticus baicalensis Dyb). Journal of Ichthyology, Amer. Fish. Soc., 10(3): 348-358.

The paper contains the first data on the composition and morphology of the blood of the 'black' Baikal grayling of different ages, including quantitative indices (hemoglobin concentration, number of erythrocytes in 1 mm^3 of blood, volume of formed elements relative to the blood plasma). The material, consisting of 625 fishes, was processed by the generally accepted procedure in hematology. An age-related pattern is characteristic of the composition and quantitative proportions of the individual blood cells of the grayling. The blood of grayling embryos consists of hemocytoblasts, early erythroblasts, and in embryos before hatching primary erythrocytes. Immature erythrocytes of the secondary series are noted in grayling larvae at an age of 10-14 days. The high rate of hematopoiesis in spawning rivers during the first year of life should be regarded as a specific feature of the 'black' Baikal grayling. Hemoglobin content, the number of erythrocytes, and the volume of formed elements increase with the age of the grayling. The mean hemoglobin norm for the 'black' Baikal grayling is 54%, the number of erythrocytes is 1.46 million/mm^3, and the volume of formed elements is 47.8%.

13144. Shentyakova, L. F., V. A. Shentyakov, V. S. Stepanov, N. F. Smirnova, V. V. Kuz'mina, O. F. Baronkin, G. D. Bayeva, and K. N. Zaytsev (Inst. of the Biology of Inland Waters, USSR Acad. of Sciences, Borok, Yaroslavl Province, USSR). 1970. THE EFFECT OF AN ALTERNATING ELECTRIC CURRENT ON FISHES AND AQUATIC INVERTEBRATES. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 363-372.

The paper contains an account of the results of observations in a reservoir on the condition of fishes and invertebrates behind a trawl electrified by alternating current, and also of the results of the authors' research on the effect of alternating current on fishes and on their food resources at the same electric field strength as the strength used in the electrified trawl and at higher strengths.

13145. Gaydash, Yu. K. (Hydrobiological Research Inst., Dnepropetrovsk State Univ., USSR). 1970. THE EFFECT OF REGULATED FLOW AND INDUSTRIAL POLLUTION ON THE FOOD SUPPLY OF BENTHIC-FEEDING FISHES IN THE DNIEPER RESERVOIR (LAKE LENIN). Journal of Ichthyology, Amer. Fish. Soc., 10(3): 380-386.

The productive macrozoobenthos of the profundal zone of the Dnieper reservoir (Lake Lenin) has become uniform under conditions of regulated flow and is represented by forms of β-α mesosaprobic type. After the flow of the Dnieper was regulated (1965-1067) there was little change in the overall abundance of the macrozoobenthos in the profundal zone of the reservoir. It was established that industrial pollution had an adverse effect on the macrobenthos of the Dnieper reservoir under conditions of regulated flow. The food supply is extremely scanty or completely non-existent in lethal and sublethal zones and in zones of depression. The incorporation of industrial effluents in the closed circulating cycle of industrial water supply in industrial undertakings will be a radical measure to improve the fish productivity of the Dnieper reservoir.

13146. Kokhanskaya, Ye. M. (A. N. Severtsov Inst. of Evolutionary Morphology and Animal Ecology, USSR Acad. of Sciences, Moscow, USSR). 1970. THE USE OF ULTRAVIOLET RADIATION FOR THE CONTROL OF DISEASE IN EGGS AND FISHES (THE MBU-3 COMPACT BACTERICIDAL PLANT). Journal of Ichthyology, Amer. Fish. Soc., 10(3): 386-393.

The bactericidal effect of ultraviolet rays, widely used in industry and medicine, was first used in pisciculture in 1956. A compact bactericidal plant (the MBU-3), which destroys parasites of fish and eggs (Saprolegnia, Ichthyophthirius, cercaria, Trichodina, etc.) was developed in 1964. The MBU-3 has undergone commercial trials and is now in production. The Committee on Inventions and Discoveries of the USSR Council of Ministers has issued inventors' certificates

and has decided to patent the MBU-3 abroad. The plant can be used in pisciculture both in the incubation of the adhesive eggs of sturgeon and teleost fishes and in the propagation of fishes with non-adhesive eggs (salmon, phytophagous fishes) and also aquarium fishes.

13147. Omarov, M. O. (Dagestan Dept. Caspian Fish. Research Inst. (KaspNIRKh), Makhachkala, USSR). 1970. THE DAILY FOOD CONSUMPTION OF THE SILVER CARP [Hypophthalmichthys molitrix (Val.)]. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 425-426.

The food consumption of the silver carp was determined by direct determination of the rate of passage of the food along the intestine with a correction for the daily feeding pattern of fishes in the second year of life weighing 320-370 g. The food passes along approximately 6.5% of the length of the intestine in a quarter of an hour and 50% in two hours. Consequently, the total passage of the food will take four hours. In the course of 24 hours the intestine is filled and evacuated six times. The daily food consumption of silver carp in June in the second year of life should equal six times the content index. In these experiments, which were carried out during the day, the figure yielded by this method of calculation was 19% of the weight of the fish. However, a correction should undoubtedly be made to these calculations for the daily feeding pattern. It consumes 25.1% of the daily food intake during the hours of darkness (from 20 to 24 hr) and 84.9% during the daylight hours. The maximum content index 4030/000 was observed at 8 AM, the minimum content index 1420/000 at 24 hr. The daily food consumption, equal to the sum of the six determinations, was 58 g or 17.2% of the weight of fishes in the second year of life.

13148. Bogdanova, L. S. (Leningrad State Univ., USSR). 1970. THE TRANSITION OF Tilapia mossambica Peters LARVAE TO ACTIVE FEEDING. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 427-429.

On the day of hatching 116 Tilapia larvae were extracted from the mouth of a female. Subsequently 50 larvae converted to active feeding on zooplankton (a mixture of Daphnia, Molna and Artemia) and 50 to feeding on plant food (ground sorrel scaled with boiling water). The larvae began to eat the two types of food on the 7th day after hatching (water temperature 24.0-26.0°C). A considerable amount of yolk still remained. The survival of the larvae until transition to active feeding was 93%. During and after transition to active feeding there was no larval mortality in any set of the experiment. The larvae were kept under observation until an age of 20 days. On transition to active feeding the larvae swim actively. Tilapia larvae were found to be omnivorous, capable of feeding on animal and plant food, from the very beginning of active feeding; this may be of positive significance in the artificial propagation of this fish. Disruption of the link with the female under the experimental conditions did not have an adverse effect on the larvae.

13149. Dorozhkina, T. Ya. (A. I. Herzen State Pedagogical Inst., Leningrad, USSR). 1970. METHODS OF RECONSTRUCTING THE GROWTH OF FISHES AS EXEMPLIFIED BY THE WHITE BREAM [Blicca bjoerkna (L.)] FROM LAKE IL'MEN'. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 430-434.

Reconstruction of the growth of fishes from the scales by various methods has shown that back calculations of the growth of the white bream in Lake Il'men' should be made by the method of G. N. Monastyrskiy. More than twenty methods for the back calculation of growth based on a rectilinear or curvilinear correlation between the body length of the fish and the size of the scale radius have now been developed. It is necessary to have a curve (regression line) of the relationship between scale growth and body growth for each fish species in different bodies of water. Use was made of three methods of back calculation for the Il'men' white bream: the method of E. Lee, the method of G. N. Monastyrskiy, and the method of P. L. Chebyshev (the method of least squares) as given by L. F. Shentyakova (1961).

13150. Shul'man, G. Ye. (Inst. of the Biology of the Southern Seas, Ukrainian Acad. of Sciences, Sevastopol', USSR). 1970. THE RELATIONSHIP BETWEEN FAT CONTENT AND THE WET AND DRY WEIGHT OF FISHES IN THE AZOV-BLACK SEA BASIN. Journal of Ichthyology, Amer. Fish. Soc., 10(3): 434-436.

When the percentage fat content in the fish body is compared with wet and dry weight it is noted that there is no linear relationship between the indices compared. In order to establish the nature of the relationship between these indices material collected by us over a number of years in the Azov-Black Sea basin was processed. The quantitative differences in the nature of the relationship between fat content in wet and dry matter in the investigated fish species are in general slight. This made it possible to construct a composite curve which, like all the initial curves, is a parabola of the form: $F_{wet} = aF_{dry}^{n}$, where a and n are coefficients respectively equal to 0.027 and 1.7. This defines the parabolic relationship between F_{wet} and F_{dry}. Therefore, the form of the curve is defined by the relationship between the dry and wet weight of the fish. It reflects the fact that as the weight of a fish increases the content of dry weight in it increases and that of moisture decreases.

13151. Westman, Kai (Bur. of Fisheries Investigation, Bd. of Agriculture, and Dept. of Physiological Zool., Univ. of Helsinki, Helsinki, Finland). 1970. HEMOGLOBIN POLYMORPHISM AND ITS ONTOGENY IN SEA-RUNNING AND LAND-LOCKED ATLANTIC SALMON (Salmo salar L.). Ann. Acad. Sci. fenn. A, IV Biologica: 170, pp. 1-28.

The hemoglobins of 195 specimens of Atlantic salmon (Salmo salar L.) from about 3 to 95 cm long originating from Bay of Bothnia river systems and landlocked salmon from Lake Saimaa have been analysed by horizontal starch gel electrophoresis at pH 8.2. All the gels were scanned by transmitted light and about 150 scannings were also integrated in detail. A complex ontogenetic change was found in the hemoglobin pattern and both the number and relative intensity of the observed multiple components varied in a definite, regular manner during growth. Concomitant with this variation the relative amount of the total hemoglobin migrating to the anode decreased and the cathodal hemoglobin increased with the size of the fish. An abrupt change in the concentration of some components was observed in sea-running salmon of 12-16 cm length. The hemoglobin pattern was in fish at that size less developed than expected for their length, i.e. the pattern had rejuvenated. A significant trend to higher concentration of total anodic hemoglobin was found in landlocked salmon during growth from about 20- to about 28 cm. The hemoglobin patterns in sea-running salmon and landlocked salmon were identical but the ontogenetic development of the hemoglobin was found to proceed faster in the latter. No intraspecific variations were found in the hemoglobin pattern of the salmon. The hemoglobin pattern of the landlocked salmon differed from that of the brown trout (Salmo trutta L.) originating from Lake Saimaa but not from sea-running salmon which confirms the suggestion made by Seppavaara (1962) that a landlocked salmon population exists in Lake Saimaa. (Auth.)

13152. Stevens, E. Don, and F. E. J. Fry (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1971. BRAIN AND MUSCLE TEMPERATURES IN OCEAN CAUGHT AND CAPTIVE SKIPJACK TUNA. Comp. Biochem. Physiol., 38(1A): 203-211.

Red muscle, white muscle, and brain temperatures were measured in skipjack tuna (Katsuwonus pelamis). Red muscle temperature was 9.1°C above an ambient water temperature of 25.6°C. Excess red muscle temperature decreased after capture, and stayed lowered while in captivity. Prolonged strenuous exercise of captive tuna resulted in an increase in their body temperature, but not to the level observed in ocean-caught fish. Brain temperature was 4.5°C above an ambient water temperature of 25.6°C. We believe that skipjack tuna regulate their body temperature over an ambient temperature range of about 25-34°C. (Authors)

13153. Snodgrass, P. J., and J. E. Halver (Dept. of Medicine, Harvard Med. School and Peter Bent Brigham Hospital, Boston, Massachusetts). 1971. POTASSIUM, SODIUM, MAGNESIUM AND CALCIUM CONTENTS OF CHINOOK SALMON TISSUES DURING VARIOUS STAGES OF THE LIFE CYCLE. Comp. Biochem. Physiol., 38(1A): 99-119.

The potassium, sodium, magnesium and calcium contents of plasma, red cells, brain, heart, muscle, liver, kidney and gills have been measured in Chinook salmon (Oncorhynchus tshawytscha) during four stages of the life cycle: (1) while juveniles in fresh water, (2) after 2 weeks in seawater, (3) as mature adults in the ocean, and (4) after 3-4 months of fasting at the spawning grounds. Although plasma cation concentrations changed with each alteration in ionic environment, a remarkable constancy of cellular cation composition is maintained except for the juveniles in seawater. The normal potassium/nitrogen ratio in the muscle of spawning salmon is inconsistent with the hypothesis that pathological hyperadrenocorticism occurs at this stage. (Authors)

13154. Gardner, Michael L. G. (Dun Donnachaidh, Pitlochry, Perthshire, Scotland). 1971. RECENT CHANGES IN THE MOVEMENTS OF ADULT SALMON Salmo salar L. IN THE TAY-TUMMEL-GARRY SYSTEM, SCOTLAND. J. Fish Biol., 3(1): 83-96.

Records from salmon counters at hydro-electric dams, and of angling results, in the Tay-Tummel-Garry river system are analysed. Spring runs of ascending salmon have decreased since at least 1950, but summer and autumn runs have increased since 1959. Hydro-electric developments are not responsible for these changes, nor for the decrease in the average weight of salmon in the system. Possible environmental factors are discussed, and a method suggested whereby the ratio of sizes of salmon populations in branches of a river system may be estimated. The numbers of descending kelts have recently increased, but the times of downstream migration have not changed. (Auth.)

13155. Braithwaite, H. (Dept. of Electronic and Electrical Engineering, The Univ. of Birmingham, Birmingham, England). 1971. A SONAR FISH COUNTER. J. Fish Biol., 3(1): 73-82.

The basic principles of a new technique for counting fish moving up or down stream are given. The counter is based on the ability to detect the presence of fish in an acoustic beam directed across the river. The counter is capable of counting several fish moving up or down stream simultaneously and is designed for use in wide open channels. The results of field trials with the equipment at two different sites are discussed together with the problems encountered. The results obtained are in good agreement with other methods of counting fish but the totals obtained were insufficient to put confidence limits on the counter. (Auth.)

13156. Shafi, Muhammed, and Peter S. Maitland (Dept. of Zoology, the University, Glasgow, Scotland). 1971. THE AGE AND GROWTH OF PERCH (Perca fluviatilis L.) IN TWO SCOTTISH LOCHS. J. Fish Biol., 3(1): 39-57.

This study is concerned with the age and growth of perch (Perca fluviatilis L.) in two contrasting Scottish lochs – the Dubh Lochan and Loch Lomond. Age and back-calculated growth were determined from annual rings in the opercular bones, and during the 2-year project 470 perch from the Dubh Lochan and 796 from Loch Lomond were examined. Growth in length in the two lochs, though similar for the first 2 years, differed thereafter, the average length at 8 years in the Dubh Lochan being less than 15 cm, that in Loch Lomond more than 23 cm at the same age. In neither locality did the growth of perch follow the Von Bertalanffy growth formula. Reasons for differential growth rates are discussed and comparisons made with the growth of perch in other waters in Europe and North America. (Authors)

13157. Ricker, W. E. 1970. THE BIOSTATISTICAL METHOD OF A. N. DERZHAVIN. (Biostatisticheskii metod A. N. Derzhavina) (Part II, conclusion). Rybnoe Khozyaistvo, No. 11, pp. 5-7.

Correct determination of the age of the fish is the most important prerequisite of the biostatistical method of A. N. Derzhavin, as well as of others.

13158. Li, M. F., and G. S. Traxler (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1971. A PROTEOLYTIC PSEUDOMONAD FROM SKIN LESIONS OF RAINBOW TROUT (Salmo gairdneri). III. MORPHOLOGICAL STUDIES. J. Fish. Res. Bd. Canada, 28(1): 104-105.

The morphology of a pseudomonad isolated from diseased rainbow trout was examined in detail. The organism was lophotrichous, and the fine structure was morphologically typical of most marine species of Pseudomonas.

13159. Ahlstrom, Elbert H. (National Mar. Fish. Serv., Fishery-Oceanography Center, La Jolla, California). 1971. KINDS AND ABUNDANCE OF FISH LARVAE IN THE EASTERN TROPICAL PACIFIC, BASED ON COLLECTIONS MADE ON EASTROPAC I. U. S. Dept. Commerce, NOAA Fish. Bull. 69(1): 3-77.

This paper deals with kinds and counts of fish larvae obtained in 482 oblique plankton hauls taken over an extensive area of the eastern tropical Pacific on EASTROPAC I, a four-vessel cooperative survey made during February-March 1967. On the basis of abundance of larvae, the dominant fish group in oceanic waters are the myctophid lanternfishes (47%), gonostomatid lightfishes (23%), hatchetfishes, Sternoptychidae (6%), bathylagid smelts (5%). Scombrid larvae ranked fifth, and exceeded 2% of the count. Two kinds of larvae were outstandingly abundant: larvae of the lanternfish Diogenichthys laternatus made up over 25% of the total, while larvae of the gonostomatid genus Vinciguerria made up almost 20%. More fish larvae were obtained per haul, on the average, in the eastern tropical Pacific than were obtained per haul in the intensively surveyed waters of the California Current region off California and Baja California. (Auth.)

13160. Rothschild, Brian J., and James W. Balsiger (Center for Quantitative Science and Fisheries Res. Inst., Univ. of Wash., Seattle, Washington). 1971. A LINEAR-PROGRAMMING SOLUTION TO SALMON MANAGEMENT. U. S. Dept. of Commerce, NOAA Fish. Bull. 69(1): 117-139.

A linear-programming model was constructed to allocate the catch of salmon among the days of the salmon run. The objective of the model was to derive a management schedule for catching the salmon which would result in maximizing the value of the landings given certain constraints. These constraints ensured that cannery capacity was not exceeded, and that escapement of both male and female fish was "adequate." In addition to considering the allocation of the catch in the primal problem, the dual problem considered the shadow prices or marginal value of the various sizes of fish, eggs, and cannery capacity, thus enabling the manager to view his decisions in light of the marginal values of these entities. As an example, the model was applied to a run of sockeye salmon in the Bristol Bay system. In the particular example, which was chosen to replicate the 1960 run, the additional value of the catch owing to optimality amounted to an ex-vessel value of a few hundred thousand dollars. In addition it appeared that the required processing time could be reduced by several days. The optimum allocation was obtained through conformance to the linear-programming model. The cost of this conformance was not, however, determined. (Authors)

13161. Crear, David, and Irwin Haydock (Calif. Dept. of Fish and Game, Inland Fish. Branch, Sacramento, California). 1971. LABORATORY REARING OF THE DESERT PUPFISH, Cyprinodon macularius. U. S. Dept. Commerce, NOAA Fish. Bull. 69(1): 151-156.

The desert pupfish, Cyprinodon macularius, may be reared in the laboratory for use in the study of embryology, genetics, physiology, and behavior. It is euryhaline (0-70%) and eurythermal (8°-44.6°C) and may be useful as a bioassay for either freshwater or marine pollutants. In the Salton Sea area of California, the recent introduction of exotic species and the encroachment of civilization have drastically reduced the formerly abundant pupfish populations. Laboratory rearing eliminates the need for continuous exploitation of a rapidly contracting natural population and could supply adequate stocks for sanctuaries, thereby preserving the species from extinction. Laboratory apparatus and conditions are described for maintaining larval and adult pupfish. Parasites and diseases encountered are

discussed and successful treatments described. Methods for spawning and rearing the desert pupfish in the laboratory are detailed. These methods may also be applicable to many other species of pupfish that are in danger of extinction. (Authors)

13162. Haydock, Irwin (Calif. Dept. of Fish and Game, Inland Fish. Branch, Sacramento, California). 1971. GONAD MATURATION AND HORMONE-INDUCED SPAWNING OF THE GULF CROAKER, Bairdiella icistia. U. S. Dept. Commerce, NOAA Fish. Bull. 69(1): 157-180.

Successful methods of capture, transport, disease treatment, and laboratory maintenance of the gulf croaker, Bairdiella icistia, are described. Gonad maturation was achieved out of season by the use of appropriate controlled photoperiods, temperatures, and abundant feeding. Mature fish or fish brought to maturity in the laboratory were spawned with suitable hormone injections and the time of spawning could be accurately predicted. Eggs obtained from hormone-induced spawning were normal in all respects and the larvae were reared through metamorphosis using rotifers and brine shrimp nauplii as food; thus, the life history of this marine fish can, for the first time, be completed under controlled laboratory conditions. The techniques developed for croakers may have application to mariculture, bioassay of marine pollution, and in more general research on marine fish reproduction. (Auth.)

13163. Hellawell, J. M., and R. Abel (Dept. of Zool., Univ. of Liverpool, and Univ. of Oxford, England). 1971. A RAPID VOLUMETRIC METHOD FOR THE ANALYSIS OF THE FOOD OF FISHES. J. Fish Biol., 3(1): 29-37.

A volumetric method in which the stomach contents are squashed to a uniform depth and the volume is derived from the area of the squash has been evaluated. The apparatus is simple in construction and the method applicable to a wide range of fish sizes. The overall error of the method may be as low as 3.5% for well macerated material, though for hard bodied food animals the coefficient of variation may be up to 8%. These volumetric determinations are not directly proportional to gravimetric measurements but logarithmic conversion curves are readily derived. (Authors)

13164. Campbell, R. N. (The Nature Conservancy, 12 Hope Terrace, Edinburgh, Scotland). 1971. THE GROWTH OF BROWN TROUT Salmo trutta L. IN NORTHERN SCOTTISH LOCHS WITH SPECIAL REFERENCE TO THE IMPROVEMENT OF FISHERIES. J. Fish Biol., 3(1): 1-28.

This paper is based on the investigation of 173 lochs in Scotland from which a total of over 4700 brown trout were examined. Twenty-four of the lochs, all in northern Scotland, and their trout populations, were selected for detailed comparison in an attempt to identify environmental factors that might affect the growth rate of trout. The lochs probably represented the full range of main standing water habitats in the region – ranging from a saline loch in the Outer Hebrides to one in a sub-arctic environment high on the Cairngorm plateau in the Central Highlands. The study indicates that for practical purposes the growth rate of trout is negatively correlated with population density. Some suggestions for improving brown trout lochs, based on the findings of this paper, are included. (Auth.)

13165. Al-Kholy, A., M. M. Ishak, Y. A. Youssef, and S. R. Khalil (Inst. of Oceanogr. and Fish., Min. of Sci. Res., Egypt, U.A.R.). 1970. PHOSPHORUS UPTAKE FROM WATER BY Tilapia zillii (Gervais). Hydrobiologia, 36(3-4): 471-478.

Laboratory experiments were carried out to find out the absorption of phosphorus from water by the fresh water fish, Tilapia zillii. The results showed that radiophosphorus dissolved in the water was absorbed and utilized by the experimental fish. The gills appear to be the main site of phosphorus uptake. Radiophosphorus was deposited in the bone and muscle tissues. The gills and gastro-intestinal tract tissues showed the highest concentration factors of the radiophosphorus. More research is suggested to study the uptake of phosphorus through the food chain. (Authors summ.)

13166. Umminger, Bruce L. (Dept. of Biol., Yale Univ., New Haven, Connecticut). 1971. OSMOREGULATORY ROLE OF SERUM GLUCOSE IN FRESHWATER-ADAPTED KILLIFISH (Fundulus heteroclitus) AT TEMPERATURES NEAR FREEZING. Comp. Biochem. Physiol., 38(1A): 141-145.

Serum chemistry was examined in freshwater-adapted killifish, Fundulus heteroclitus, acclimated to 11, 4 and 0.1°C. Acclimation to 0.1°C caused a 30 percent decrease in serum sodium, a 42 percent decrease in serum chloride, but only a 15 percent decrease in serum osmolality. The reduction in serum osmolality was not as great as the decrease in serum electrolytes because serum glucose increased by 1967 percent at 0.1°C. Serum glucose increased from 2.8 m-moles/l. at 11°C to 59.2 m-moles/l. at 0.1°C. The levels of serum glucose (1066.6 mg%) in freshwater-adapted killifish at 0.1°C are the highest known for any fish. (Auth.)

13167. McErlean, Andrew J., and H. J. Brinkley (Natural Resources Inst., Hallowing Point Sta., Rte. 1, Prince Frederick, Maryland). 1971. TEMPERATURE TOLERANCE AND THYROID ACTIVITY OF THE WHITE PERCH Roccus (= Morone) americanus. J. Fish Biol., 3(1): 97-114.

The seasonality of temperature tolerance using thiourea-treated, normal and thyroxine-treated white perch was determined after laboratory acclimation and LD50 values calculated by normit analysis. Treatment effects, reflected in slight shifts in LD50 values were evident. However, these did not fit a consistent pattern of thyroidal involvement in temperature tolerance. When specimens of known thyroidal functional state were used in tolerance tests, results, similar to the seasonal tolerance tests, were obtained. Thus, although the white perch has a functioning thyroid capable of forming radiohormone and this capability was experimentally varied in these tests, no tolerance shifts were noted. Data obtained in tolerance testing were statistically adjusted to partition out variation due to differences in acclimation temperatures (season) and to test for treatment (thyroidal functional state) effects. Treatment difference was not significant while that due to season was significant ($P < 0.01$). Thyroidal functional state was thus unrelated to tolerance. (Authors)

13168. Cairns, John, Jr. (Virginia Polytechnic Inst., College of Arts and Sci., Blacksburg, Virginia). 1971. THERMAL POLLUTION - A CAUSE FOR CONCERN. J. Wat. Poll. Contr. Fed., 43(1): 55-66.

Society cannot continue to expand production of electric power and increase discharge of heated wastewater into the aquatic environment indefinitely without causing a major ecological crisis. Most aquatic organisms can withstand the effects of heat only within very narrow limits. They are further handicapped by not having regulatory mechanisms (such as sweating) which buffer effects of increased heat in the environment. Though abrupt application of heat can kill bacteria and other microorganisms (pasteurization is an example) the probable result of gradual changes in a natural environment is exclusion of nontolerant species by resistant species. The result is a qualitative shift in kinds of species present which may or may not be accompanied by a change in total numbers of individuals. The species relationships in one experiment shifted as the temperature rose from 68°F (20°C) to 104°F (40°C). The number of species of diatoms dropped sharply; the trend among blue-green algae was the opposite - there were more species present in the warmer water. Species of green algae increased with rising temperature until it passed 86°F (30°C) and then dropped off again. Present evidence suggests that blue-greens are not as suitable as diatoms to the organisms dependent on algae as a food supply. Many blue-greens produce unpleasant odors, and some are toxic to shellfish and other organisms. The major effects of heat pollution on higher aquatic organisms are: 1. Death through direct effects of heat; 2. Internal functional aberrations (changes in respiration, growth); 3. Death through indirect effects of heat (reduced oxygen, disruption of food supply, decreased resistance to toxic substances); 4. Interference with spawning or other critical activities in the life cycle; and 5. Competitive replacement by more tolerant species as a result of the above physiological effects. The problems caused by heated wastewater discharge into lakes probably are as complex as

those in rivers, though data on lakes is quite scarce. One might think that the vast oceans would be immune to effects of heat pollution and that therefore electric generating plants could best be placed along the coasts, but since marine life is frequently concentrated in coastal areas, this may not be the easy solution it seems to be on first inspection. For example, it has recently been reported that a combination of heat and salt pollution caused by waste discharge from the Point Loma saline water conversion plant near San Diego, Calif., has affected intertidal marine life. It may well be that the ultimate limitation on the number of people the earth can support will be the capacity of the environment to transform wastes into acceptable or useful materials. Because man depends on the environment as a life support system, an attempt should be made to understand its waste transforming capacities which are as integral a part of the life-support system as is the food supply. Man can no longer afford merely to insure the survival of the ecosystems which provide oxygen and transform wastes. He must also determine the conditions required for optimal function, because, with the predicted increase in rate of loading with wastes, nothing less than optimal function will prevent disaster., There are four basic alternatives that are open with regard to the heated wastewater problem, which may be chosen singly or in various combinations: 1. Placing all heated wastewater in streams, lakes, and oceans without regard to the effect and considering the environmental damage as a necessary consequence of the increased power demand; 2. Using, but not abusing, present ecosystems. This means regulating the heated wastewater discharge to fit the receiving capacity of the ecosystem; 3. Finding alternative ways to dissipate or beneficially use waste heat; and 4. Modifying ecosystems to fit the new temperature conditions. Man depends on a life support system that is partly industrial and partly ecological. Unfortunately, he has reached a stage of development where the nonexpandable portion of the life support system, the ecological part of the environment, is endangered by the expanding industrial portion of the environment. Developing a balanced life support system that serves the greatest variety of beneficial uses will not be possible unless narrow discipline-oriented, single-purpose views toward environmental management and use are abandoned. Optimal use and management of such a complex system will only be possible with the full cooperation of engineers, ecologists, congressmen, economists, urban and regional planners, regulatory agencies, businessmen, geologists, to mention just a few of the many sources of critical points of view. The decisions are too important to be left to a single group — too complex to be solved by a single discipline. (From auth.)

13169. Hokanson, Kenneth E. F., and Lloyd L. Smith, Jr. (Dept. of Entomol., Fisheries and Wildlife, Univ. of Minn., St. Paul, Minnesota). 1971. SOME FACTORS INFLUENCING TOXICITY OF LINEAR ALKYLATE SULFONATE (LAS) TO THE BLUEGILL. Trans. Amer. Fish. Soc., 100(1): 1-12.

Some factors influencing toxicity of linear alkylate sulfonate (LAS) on the early life history stages of the bluegill, Lepomis macrochirus (Rafinesque), were studied in raw Mississippi River water under ambient conditions and under controlled conditions in well water. Median response varied from 0.2-10 mg/l LAS with the life history phase and environmental conditions. Variation in estimation of TL_m values within and between similar tests was small in comparison to the influence of external factors. The most important environmental factors related to lethal threshold concentration of LAS were dissolved oxygen, water hardness, and acclimation to LAS. High temperature decreased the median tolerance limit only during tests of short exposure. Sublethal concentrations of LAS increased toxicity of fuel oil mixtures while bentonite suspensions up to 200 mg/l had little influence on LAS toxicity. The most sensitive stage of development was the feeding sac-fry, while the most tolerant stage was the newly hatched sac-fry. Eggs and fingerlings had similar intermediate tolerance limits. Egg fertilization was the least inhibited of the events studied. A concentration of 1 mg/l LAS is considered to be a first approximation of a safe concentration for bluegills in Mississippi River water of good quality. (Authors)

13170. Lee, Terrence H., Philip H. Derse, and Stephen D. Morton (WARF Inst., Inc., 506 Walnut St., Madison, Wisconsin). 1971. EFFECTS OF PHYSICAL AND CHEMICAL CONDITIONS ON THE DETOXIFICATION OF ANTIMYCIN. Trans. Amer. Fish. Soc., 100(1): 13-17.

Laboratory studies using both fish and yeast assays were made to determine the effects of various physical and chemical conditions on the toxicity and stability of antimycin. Chemical studies determined that pH is the most important factor. Half-lives of antimycin for pH's of 4.5 to 11.0 varied from over seven hours to six minutes. Alkalinity and hardness were of no significance. Sorption on Lake Mendota, Wisconsin sediments was negligible up to suspended solids concentrations of 1.5%. The half-life in sunlight of antimycin in distilled water was less than 10 minutes; at 200 foot candles about the same as in darkness. Mortality time for fish increased by approximately a factor of three for 4C compared to 24C. Use of ethanol as an anti-freeze for winter use was satisfactory. (Authors)

13171. Savitz, J. (Dept. of Zool., Indiana Univ., Bloomington, Indiana). 1971. EFFECTS OF STARVATION ON BODY PROTEIN UTILIZATION OF BLUEGILL SUNFISH (Lepomis macrochirus Rafinesque) WITH A CALCULATION OF CALORIC REQUIREMENTS. Trans. Amer. Fish. Soc., 100(1): 18-21.

Nitrogen excretion rates were measured for bluegill sunfish (Lepomis macrochirus) starved for periods of 7, 14, 21, and 28 days, and for glucose-fed controls. The starved fish had lower nitrogen excretion rates than controls, but there was no significant difference between average nitrogen excretion rates of starved fish from the four experimental periods. Body composition was analyzed. Protein and fat content decreased with starvation but ash content remained unchanged when compared to controls. The caloric requirement for starved bluegills was calculated on the basis of the change in organic composition of the body. (Auth.)

13172. Spoor, W. A., T. W. Neiheisel, and R. A. Drummond (Fed. Wat. Qual. Admn., National Wat. Qual. Lab., Duluth, Minnesota). 1971. AN ELECTRODE CHAMBER FOR RECORDING RESPIRATORY AND OTHER MOVEMENTS OF FREE-SWIMMING ANIMALS. Trans. Amer. Fish. Soc., 100(1): 22-28.

By their effects on equilibrium potentials, water currents produced by respiratory and other movements of freely-moving animals cause changes in the potential difference between stainless steel electrodes set at opposite ends of an open system continuous-flow animal chamber. The changes are in the microvolt range, but they can be used for continuous or intermittent recording of the animals' responses in short-term or long-term studies under widely varied environmental conditions, and the method seems suitable for monitoring. (Authors)

13173. Merriner, John V. (No. Carolina Coop. Fish. Unit, No. Carolina State Univ., Raleigh, No. Carolina). 1971. EGG SIZE AS A FACTOR IN INTERGENERIC HYBRID SUCCESS OF CENTRARCHIDS. Trans. Amer. Fish. Soc., 100(1): 29-32.

The diameter of eggs was measured for 4 species of sunfishes representing 4 genera. The egg size was compared to hybridization success reported for these species to evaluate egg size as a factor determining hybridization success. Average diameters were: Pomoxis nigromaculatus (Le Sueur), black crappie (0.93 mm); Chaenobryttus gulosus (Cuvier), warmouth (1.01 mm); Lepomis macrochirus Rafinesque, bluegill (1.09 mm); and Micropterus salmoides (Lacépède), largemouth bass (1.74 mm). Highly significant differences (.01 level) existed between P. nigromaculatus and L. macrochirus eggs and between M. salmoides eggs and all other species measured. Hybrid success (hatching, deformities, embryonic death, etc.) did not show relationship to egg size for crosses among these species. Reciprocal cross data for L. macrochirus eggs, in particular, indicated that the causative factors determining hybridization success involve factors other than egg size. (Auth.)

13174. Madsen, Monte L. (Comm. Fish. Section, Nebraska Game and Parks Commission, North Platte, Nebraska). 1971. THE PRESENCE OF NUPTIAL TUBERCLES ON FEMALE QUILLBACK (Carpiodes cyprinus). Trans. Amer. Fish. Soc., 100(1): 132-134.

13175. Raleigh, R. F., and D. W. Chapman. 1971. GENETIC CONTROL IN LAKEWARD MIGRATIONS OF CUTTHROAT TROUT FRY. Trans. Amer. Fish. Soc., 100(1): 33-40.

Cutthroat trout (Salmo clarki) in Yellowstone Lake spawn in the inlets or in the outlet, Yellowstone River. Fry from natal gravels in inlets move downstream to the lake rearing area while most fry from the outlet move upstream to the lake. We examined the roles of temperature, water source, and innate control in directing migrations of fry. We collected fertilized eggs from cutthroat in an inlet and the outlet of Yellowstone Lake, and incubated them under identical environmental conditions at Jackson, Wyoming. Our test facility on the shore of Yellowstone Lake consisted of three simulated stream sections 14.6 m long, 0.3 m wide, and 6.3 cm deep with a trap at each end. We controlled water temperature with a heater and coolers, and could test fish in pumped lake or stream water. We introduced fry at dusk at the mid-point of the stream sections, and counted fish which moved upstream or downstream within 12 hours. We kept environment and handling procedures identical during the tests for lots of inlet and outlet fry. The source of acclimation water did not significantly affect direction of migration of fry from either inlet or outlet populations when tested with lake water. Water temperature significantly altered ratios of outlet fry moving upstream and downstream but did not affect direction of movement of inlet fry. We concluded that upstream and downstream migrations by cutthroat fry from inlet and outlet populations were largely controlled by innate responses to environmental stimuli. Our work and other recent studies indicate that the specifically and racially different migration patterns of emergent salmonid fry (Oncorhynchus nerka, Salmo gairdneri and S. clarki) from natal gravels to rearing areas embody genetic-environmental interactions. Failure by resource managers to match innately-controlled migration characteristics of a donor population to the requirements of the new environment may explain some unsuccessful attempts to transplant fish. (Authors)

13176. LaBar, George W. (Zool. and Entomol. Dept., Montana State Univ., Bozeman, Montana). 1971. MOVEMENT AND HOMING OF CUTTHROAT TROUT (Salmo clarki) IN CLEAR AND BRIDGE CREEKS, YELLOWSTONE NATIONAL PARK. Trans. Amer. Fish. Soc., 100(1): 41-49.

Mature cutthroat trout (Salmo clarki) exhibited in-season homing to tributaries and redds in Clear and Bridge Creeks, Yellowstone National Park, in 1967, 1968 and 1969. Of 532 fish displaced from a small stream tributary to Clear Creek, 135 (26.4%) homed, 23 (4.5%) strayed and 281 (52.8%) were unaccounted for. Significantly fewer anosmic and blind fish homed than controls. More blind fish strayed than other groups. Of 190 fish displaced from the North and South Forks of Bridge Creek in 1968 and 1969, 60 (31.6%) homed, 7 (3.6%) strayed and 114 (60.0%) were unaccounted for. Fewer anosmic and blind fish homed than control and non-anesthetized. Mean homing times were shortest for non-anesthetized and progressively greater for control, anosmic and blind fish in both Clear and Bridge Creeks. Mean homing time for all groups from Clear Creek in 1969 was double that of 1968. Twenty-nine (40.9%) of 71 fish displaced from redds in Clear Creek in 1969 homed to the same redd from which they were taken. Eighteen (25.4%) returned to within 2-3 m of the home redd. Nine (12.7%) strayed and 14 (19.7%) were unaccounted for. Homing to redds did not appear to be affected by the distance displaced. (Auth.)

13177. Beyerle, George B. (Mich. Dept. of Natural Resources, Hastings, Michigan). 1971. A STUDY OF TWO NORTHERN PIKE - BLUEGILL POPULATIONS. Trans. Amer. Fish. Soc., 100(1): 69-73.

Northern pike and bluegill populations were established and maintained for 3 years in two small lakes closed to fishing. Growth of pike was slightly less than the average for pike in Michigan; growth of bluegills ranged from 3.6 to 7.4 cm (1.4 to 2.9 inches) below state average. High densities of pike (68 to 78 per hectare; 28 to 32 per acre) did not control an abundance of bluegills. Survival of pike from the initial stocking was extremely high (44-60%), whereas survival from subsequent plantings was low (0.8-9.2%). (Auth.)

13178. Babcock, W. H. (Research Center, Colo. Div. of Game, Fish and Parks, Fort Collins, Colorado). 1971. EFFECT OF A SIZE LIMIT REGULATION ON THE TROUT FISHERY IN TRAPPERS LAKE, COLORADO). Trans. Amer. Fish. Soc., 100(1): 50-54.

Early studies (1960-63) at Trappers Lake indicated an exploitation of the spawning population of cutthroat trout. A 254 mm size limit was imposed in 1964, and during 1967-68 various aspects of the trout fishery and population were measured to assess effect of the regulation. Statistical analysis of creel census data indicated no significant difference in catch per man hour between years. Neither was there a statistically detectable change in the size structure of the population nor a demonstrable difference between mean spawner age for each year. There was no significant difference between length and weight data for two pre-regulation years. Indications are that the size limit had little, if any, measurable effect on the cutthroat trout population. (Auth.)

13179. Hansen, David J. (Oregon State Game Commission, Corvallis, Oregon). 1971. EVALUATION OF STOCKING CUTTHROAT TROUT, Salmo clarki, IN MUNSEL LAKE, OREGON. Trans. Amer. Fish. Soc., 100(1): 55-60.

Natural mortality, emigration, and yield to anglers were assessed in 1962 for three releases of cutthroat trout (Salmo clarki) in Munsel Lake, Oregon. Stocked fish were caught emigrating from March 30, the start of trapping, to July 3. Natural mortality, 16 to 75%, was the dominant factor determining the number of fish available to anglers, and this mortality was greatest when anglers could not fish immediately after stocking. Yield of trout to anglers, estimated by creel census, indicated that after release fish were removed rapidly from the lake. Catch by anglers could be increased and catch per unit effort stabilized by liberating trout just before the fishing season and once or twice in the summer. This policy could reduce losses of fish from natural mortality and emigrations. (Auth.)

13180. Johnson, James E. (Dept. of Zool., Arizona State Univ., Tempe, Arizona). 1971. MATURITY AND FECUNDITY OF THREADFIN SHAD, Dorosoma petenense (Gunther), IN CENTRAL ARIZONA RESERVOIRS. Trans. Amer. Fish. Soc., 100(1): 74-85.

It is necessary to determine maturity of a fish before accurate fecundity estimates are attempted. Ovary weight divided by the gross body weight (the maturity index) was found to reliably describe stages of maturity for threadfin shad when used in conjunction with size distribution of ova in the ovary. Females are incapable of releasing mature ova until ovary weights have increased to 19% or more of the body weight, even though mature ova may be found at lower maturity indices. Threadfin shad spawn once a year in the Salt River reservoirs, with fecundities ranging from 923 to 8, 540 ova. Young-of-the-year fish do not spawn in their first growing season, even when attaining minimum spawning size (49 mm) before the end of summer. Older fish spawn nearly two months before age-I fish, but a second complement of eggs that older fish begin to mature appears to be resorbed rather than spawned. A high percentage of the older fish fail to reproduce, with adipose tissue replacing gametes in the gonads. Percentages of abnormal gonads are relatively low in younger fish. (Auth.)

13181. Klima, Edward F., and Donald A. Wickham (NMFS, Exploratory Fishing and Gear Res. Base, Pascagoula, Mississippi). 1971. ATTRACTION OF COASTAL PELAGIC FISHES WITH ARTIFICIAL STRUCTURES. Trans. Amer. Fish. Soc., 100(1): 86-99.

Artificial structures positioned off Panama City, Florida, during July 1969 proved effective in attracting commercial quantities of scad, Spanish sardines, and scaled sardines. The structures' position in the water column and their design were important in attracting fish. Midwater structures which resembled a small pup tent were effective in attracting up to 25 metric tons of fish and consistently attracted from 1/2 to 5 metric tons daily. SCUBA divers made visual estimates of the number of each species present at the structures. We discuss the behavior of the fish and present a possible explanation of why fish are associated with submerged structures. (Authors)

13182. Peters, Nicolaus, and Gabriele Peters (Inst. for Hydrobiology and Fishery Science of the Univ. of Hamburg, Germany). 1970. TUMORGENESIS, A SUBJECT CONCERNING CELLULAR ENERGY SUPPLY? STUDIES OF PAPILLOMA IN THE EUROPEAN EEL, Anguilla anguilla (L.). Arch. FischWiss., 21(3): 238-257, (In German with English summary).

Tumor cells have a decrease in aerobic respiration and an increase in glycolysis. Recent studies indicate a direct relationship between this change in metabolism and malignancy. Currently it is not known how important this phenomenon is with respect to tumorgenesis. We treated papilloma of the European eel in situ with an energy rich inorganic phosphate ($Na_4P_2O_7$) added to the ambient medium. Low concentrations cause the formation of new mucous cells in the epidermal tumor which we recognize as representing a higher degree of tissue differentiation. A gradual increase in dosage brings about breakdown and rejection of the tumor. This process has characteristics similar to an immune reaction. Possibly the energy supplied by the administered diphosphate gives rise to greater antigenecity of the tumor cells. Consequently, a strong immune reaction occurs. However, metabolic energy inhibitors cause a dedifferentiation and a higher growth rate of the normal tissue. Teleost embryos loose their organ anlagen under the influence of KCN and DPN. In the epidermis of the eel tumorlike proliferations develop in 24 hours after addition of fluoride ions or iodoacetate. The effect of these metabolic energy inhibitors is nullified by the concurrent application of the inorganic diphosphate. We base the interpretation of our results and those reported by others on the fact that the development and maintenance of highly specialized cells require a great amount of energy. Different harmful agents cause an increased energy demand for cellular reparation and regulation. A constant energy drain results in damage to the oxidative metabolic machinery and a consequent general cellular dedifferentiation. This dedifferentiation implies a diminution in cellular surface antigenicity and loss of informative contact between cells of the tissue. This increases the mitotic rate, the energy for which might be made available by dedifferentiation. Tumor cells are basically degenerative. This statement is supported by the fact that cells or different tumors undergo a convergent morphological and biochemical change with increasing malignancy. Convergence is a basic characteristic of regressive processes. (Authors summ.)

13183. Plate, G. (Veterinary-Medical Science Div. of the Farbenfabriken Bayer AG, Leverkusen, Germany). 1970. USE OF MASOTEN® TO CONTROL ECTOPARASITES OF FISH. Arch. FischWiss., 21(3): 258-267, (In German with English summary).

Masoten is especially used for ectoparasite control in fish. With pond treatment, it is reliably effective against Argulus and Lernaea (0.2 - 0.4 ppm), Dactylogyrus, Gyrodactylus, Piscicola and other leeches (0.25 - 0.5 ppm), and Trichodina (2.0 ppm). According to individual reports, the following parasites can be effectively controlled too: Ergasilus (0.15 ppm), Cleidodiscus (0.25 ppm), Gerris (0.2 - 0.4 ppm), and a Philometra sp. (1-2 ppm). Pond treatment is recommended for carp, eel and trout; however, for the latter ones no more than 0.2 ppm. The concentrations mentioned refer to active ingredient. Phytoplankton, oxygen content, and pH value of the water are not affected. Some species of zooplankton are temporarily reduced. Masoten is also effective in salt water. Mussels are insensitive. A 5-10 minutes tank treatment of carp in a 2.5-3% Masoten solution (2.0-2.4% a.i.) reliably acts against Argulus, Dactylogyrus and Gyrodactylus. A partial effect on Trichodina, Chilodonella and Ichthyophthirius can be expected. (Auth. summ.)

13184. Aker, E. (Inst. for Coastal and Freshwater Fishery of the Fed. Fishery Research Inst., Hamburg, Kiel Lab., Germany). 1970. RED DISEASE OF EEL IN THE GERMAN BIGHT. Arch. FischWiss., 21(3): 268-269, In German.

The occurrence of red disease of eel in the German Bight is discussed in connection with the presence of Vibrio anguillarum.

13185. Lindahl, P. E., and C. E. B. Hell (Inst. of Zoophysiology, Uppsala, Sweden). 1970. EFFECTS OF SHORT-TERM EXPOSURE OF Leuciscus rutilus L. (PISCES) TO PHENYLMERCURIC HYDROXIDE. Oikos, 21(2): 267-275, Copenhagen.

The effects of phenylmercuric hydroxide (PMOH) on Leuciscus rutilus L. (Pisces) was studied after the acute exposure of fishes to a concentration of 1.0 mg/l (0.3×10^{-5} M). The respiration of isolated gill filaments was inhibited by about 30 percent. The cause of this inhibition was chiefly the damage to the secondary lamellae. When the oxygen content of blood drawn from the fishes was measured, a pronounced decrease (82 percent) was obtained, compared with that of blood drawn from untreated specimens. The haemolytic effect of PMOH on fish erythrocytes was studied in vitro. The half-haemolysis time was 55 min. at a concentration of 0.5×10^{-4} M. No degree of haemolysis had occurred in blood drawn from poisoned fishes. A small inhibition (9 percent) was found in the oxygen consumption of brain slices from animals exposed to PMOH. The oxygen uptake of both liver slices and liver mitochondria from exposed animals increased by 15 and 20 percent respectively while glycolysis was inhibited by about 20-25 percent. (Authors)

13186. Federal Water Quality Administration. 1970. 1969 FISH KILLS CAUSED BY POLLUTION. CWA-7 1969 U. S. Govt. Printing Office: 1970 O—410-884. For sale by the Supt. of Documents, U. S. Govt. Printing Office, Washington, D. C. 20402, price 20 cents, 20 pages, illus.

Water pollution killed an estimated 41 million fish in 45 States in 1969. This was by far the highest number of fish deaths reported since the annual census began in June 1960. The 1969 figure of fish fatalities represented an increase of 170 percent over 1968 when about 15 million fish died in 42 States. Since fish kill census-taking began, in June 1960, a total of 144.6 million fish have been reported killed in more than 4,200 separate incidents. The record increase in fish kills reported in 1969 can be related in part to the greater cooperation given by State reporting officials, to improved reporting practices, to greater public attention to fish kills, and to an unusually large single kill. By far the largest single pollution-caused fish kill reported in 1969 - 26.5 million fish - occurred in Lake Thonotosassa at Plant City, Florida. Effluent from industrial and municipal sewage treatment operations has been entering the lake untreated for some 15 years. Nutrients in these wastes reduced the oxygen in January 1969 to a level in which fish could not survive. Industrial operations were responsible for both the highest number of incidents and the highest number of fish killed in 1969. Some 199 cases of industrial pollution were reported, resulting in the death of 28.9 million fish. Municipal pollution, which in 1968 accounted for most of the fish deaths - 7.0 million - killed the fewest number of fish in 1969 — 1.2 million. Of the five States not included in the census, Hawaii submitted two reports of kills but the source of the pollution could not be determined. Two States - Nevada and North Dakota - reported no fish kills. There were no reports from Maryland and Mississippi. The annual fish kill reports are received from cooperating State fish and game and State pollution control agencies. The reports are prepared in cooperation with the Department of the Interior's Bureau of Sport Fisheries and Wildlife. (Foreword)

13187. Iversen, E. S., N. Chitty, and N. Van Meter (Univ. of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Miami, Florida). 1971. SOME MYXOSPORIDA FROM MARINE FISHES IN SOUTH FLORIDA. J. Protozool., 18(1): 82-86.

Myxsoma cephalis n. sp. is described from the brain meninges, gills, jaw bone, crop tissue and buccal cavity of Mugil cephalus Linnaeus (striped mullet) of south Florida. The fresh spore is subspherical in front view, lenticular in side view and averages $14.1 \times 11.0 \times 9.0$ μ (length, width, thickness). The sutural ridge is broad, the sutural line is faintly visible and the polar filaments are coiled 4-5 times. This parasite is apparently associated with an epizootic in mullet. Three species of beloniform fishes from south Florida waters were examined for myxosporidan parasites. New host records and extensions of ranges are provided for Myxidium sphaericum Thelohan in Strongylura timucu (Walbaum) (timucu), and Ceratomyxa

aggregata Davis in Hyporhamphus unifasciatus (Ranzani) (halfbeak). A single spore of the genus Myxidium was found in the gall bladder of Hemiramphus brasiliensis Linnaeus (ballyhoo). (Authors synopsis)

13188. Thorne, Richard E., and James C. Woodey (Wash. Univ., Seattle, Washington). 1970. STOCK ASSESSMENT BY ECHO INTEGRATION AND ITS APPLICATION TO JUVENILE SOCKEYE SALMON IN LAKE WASHINGTON. Available from NTIS as PB-190 366, $3.00 in paper copy, $.95 in microfiche, Circular No. 70-2; Selected Water Resources Abstracts, 4(4): p. 10.

An echo integrator for use in the estimation of fish populations was designed and built. The first part of this paper describes an investigation into the relationship between the integrated echo strength of the echo integrator and number of juvenile sockeye salmon. The second part details an estimation of the pelagial population of presmolt sockeye salmon in Lake Washington by means of the echo integrator.

13189. Nelson, Wesley C. (Colorado Dept. of Natural Resources, Ft. Collins, Colorado). 1970. COLORADO TROUT LAKE STUDIES. Available from NTIS as TID-25342 $3.00 in paper copy, $.95 in microfiche. Progress Report for 1969, 12 p.; Selected Water Resources Abstracts, 4(4): p. 11.

Limnological measurements were made on water temperature, depth of secchi disk visibility and dissolved oxygen concentrations. All fish caught were identified, sexed, weighed, and measured, and representative samples were taken for analysis of 137Cs concentrations in muscle tissue. Results of studies on three lakes are tabulated. Mean concentrations of 137Cs remained relatively high in rainbow trout from Lower Agnes Lake, and cutthroat trout from Upper Snow Lake. From these results it is concluded that in the event of renewed contamination of the environment by radioactive fallout, the larger fish from similar montane and alpine lakes would present the greatest potential health hazard if caught and consumed by fishermen.

13190. Reith, Jan F., R. H. Frost, C. A. Schrijver, and R. J. A. M. Albers (Utrecht Rijksuniversiteit, Netherlands). 1969. DEMONSTRATION OF TOXIC SUBSTANCES BY USING THE FISH, Lebistes reticulatus (DUTCH). Pharmieutisch Weekblad 104, No. 14, pp. 273-287; Selected Water Resources Abstracts, 4(4): p. 32.

Comparison of the effect of dieldrin on the sensitivity of 2 groups of L. reticulatus showed that 3-day-old guppies were more sensitive than 21-day-old guppies. The tests were carried out in 1-l. beakers contg. a previously reported British medium (1966). Five to six guppies were acclimatized at 23 for 45 min. in these beakers after which the toxic substance in 1 ml. acetone was added. The animals were observed for toxic symptoms and the number of dead animals was recorded after 6 and 24 hours. The reproducibility of the results was good, although differences were observed between different generations and also between guppies from other sources. This test is esp. useful for testing pesticides (i.e. DDT, lindane, chlordane), while good results were obtained with phosphate esters, Sevin, carbamates, tetramethylthiuram disulfide and hg compounds. Other compounds toxic to guppies included: CdCl2, phenothiazine, phenacetin strychnine, and others. Testing of the material was done after isolation of the toxic material from organs, stomach contents, and excreta. Some pesticides may cause 100% death in a conc. of 0.01 mg/l, and others only between 0.1 and 1 mg/l. Other toxic compounds, (nonpesticides), such as medicines, may have a lethal effect between 3 and 10 mg/l. In many cases this test is less sensitive than the one with Drosophila melanogaster.

13191. Sherman, Kenneth, and Herbert C. Perkins (Bur. Comm. Fish. Biol. Lab., West Boothbay Harbor, Maine). 1971. SEASONAL VARIATIONS IN THE FOOD OF JUVENILE HERRING IN COASTAL WATERS OF MAINE. Trans. Amer. Fish. Soc., 100(1): 121-124.

13192. Gloxhuber, Ch., and W. K. Fisher. 1968. STUDIES ON THE ACTION OF HIGH CONCENTRATIONS OF ALKYLPOLYGLYCOL ETHERS ON FISH (GERMAN). Fd. Cosmet. Toxicol., Vol. 6, pp. 469-477; Selected Water Resources Abstracts, 4(4): p. 32.

In solutions of lethal concentrations of alkylpolyglycol ethers, belonging to the group of nonionic detergents, fish exhibit a picture of intoxication different from that in lethal solutions of anionic detergents. The reduction in the surface tension of the water seems to be the basic cause of the poisoning of fish by anionic detergents. The studies have shown that this largely applies also to the alkylpolyglycol ethers, but while the action of anionic detergents is limited to the gills, alkylpolyglycol ethers pass through the gills and are absorbed. The course of the intoxication resulting from action on the gills corresponds to that following absorption through the peritoneal cavity. The symptoms of poisoning after absorption of alkylpolyglycol ethers show a marked similarity to those due to detracaine and procaine, the type and course of the narcotic symptoms being like those already known to local anaesthetics.

13193. Ebel, Wesley, Earl M. Dawley, and Bruce Monk (Bur. of Comm. Fish., Biol. Lab., Seattle, Washington). 1970. THERMAL TOLERANCE OF JUVENILE SALMON IN RELATION TO NITROGEN SUPERSATURATION. Report, Sept. 1970, 28 p.; Selected Water Resources Abstracts, 4(4): p. 33.

Described are the results of experiments designed to determine the effect of supersaturation of nitrogen gas on thermal tolerance of 3 species (Oncorhynchus kisutch, O. tshawytscha, and Salmo gairdneri of juvenile salmonids. The data indicated that tolerance of all 3 species at all acclimation temperatures was lowered and that LE50 rates were accelerated when supersaturation of nitrogen at 125-130 percent was present in the test water. Increasing the depth of the test tanks allowed the fish to compensate somewhat for the supersaturation by sounding, but substantial mortalities still occurred. Tests revealed that coho were the most tolerant, chinook next, and steelhead the least tolerant to temperature increases in the presence of supersaturation of nitrogen.

13194. Neuhold, John M., and R. K. Sharma (Utah State Univ, Center of Ecology, Logan, Utah). 1967. INTERACTING EFFECTS OF GAMMA RADIATION AND SODIUM HALIDE CONCENTRATIONS ON RAINBOW TROUT. Proc. of Second National Symposium on Radioecology, Ann Arbor, Mich., May 15-17, pp. 142-151; Selected Water Resources Abstracts, 4(4): p. 33.

The objective of the experiment was to investigate the effects of gamma ray doses and halide concentrations on rainbow trout survival, and to develop possible explanations for the patterns of mortality, that result from these interactions. Mortality of 137 Cs gamma irradiated rainbow trout subjected to aquarium medium levels of sodium fluoride, sodium chloride, sodium bromide and sodium iodide displayed significant response to either time by gamma dose, time by sodium halide concentration interactions. The interactions were concluded to be caused by radiation induced changes in oxygen uptake and sodium uptake and excretion.

13195. Dempster, Robert P., and William H. Shipman (Calif. Acad. of Sci., San Francisco, California). 1969. THE USE OF COPPER SULFATE AS A MEDICAMENT FOR AQUARIUM FISHES AND AS AN ALGAECIDE IN MARINE MAMMAL WATER SYSTEMS. Occasional Papers of the Calif. Acad. of Sci., No. 71, 6 p.; Selected Water Resources Abstracts, 4(4): p. 34.

This paper describes the use of copper sulfate to control algae and fish ectoparasites in marine aquaria. The method introduced in this paper prevents copper precipitation in alkaline water, thus permitting copper ions to be maintained in solution. Copper compounds must be utilized with considerable caution since they are toxic to all forms of life. Therefore, a technique is given by which, once the concentration of copper in the water system is adjusted, sequestered copper is added at a rate sufficient to maintain the concentration. This procedure has been used for the last 15 years at the Steinhart Aquarium, and as a result there has been no outbreak of fish disease. Copper concentrations up to 1 ppm have been used.

13196. Fulton, Leonard A. (Natl. Marine Fish. Serv. Biol. Lab., Seattle, Washington). 1970. SPAWNING AREAS AND ABUNDANCE OF STEELHEAD TROUT AND COHO, SOCKEYE, AND CHUM SALMON IN THE COLUMBIA RIVER BASIN - PAST AND PRESENT. U. S. Dept. Commerce, NOAA, NMFS, Special Scientific Report - Fisheries No. 618, 37 p. with maps.

Past spawning areas (those removed from use before 1969) and present ones (those in use in 1969) are described for steelhead trout, Salmo gairdneri; coho salmon, Oncorhynchus kisutch; sockeye salmon, O. nerka; and chum salmon, O. keta. The different species characteristically spawn in the following areas: (1) steelhead trout – in streams of all sizes (widely dispersed throughout the watershed, (2) coho salmon – in small streams (mostly in the lower tributaries) and in a few areas in the middle watershed, (3) sockeye salmon – in lakes and tributaries of lakes (in the middle portion of the watershed), and (4) chum salmon – in lower portions of tributaries that enter the Columbia River below The Dalles Dam. All four species have lost many spawning areas because of water-use developments and changes in the watershed resulting from logging, highway construction, agricultural cultivation, placer mining, and dumping of wastes. Serious depletion of the runs of all four species is evident from the available data (the commercial catches before 1938 and since 1938 augmented by information on escapement and sport catch). The future prospects are fair for steelhead trout, good for coho salmon, and poor for sockeye and chum salmon. (Auth.)

13197. Patten, Benjamin G. (National Marine Fish. Serv. Biol. Lab., Seattle, Washington). 1971. PREDATION BY SCULPINS ON FALL CHINOOK SALMON, Oncorhynchus tshawytscha, FRY OF HATCHERY ORIGIN. U. S. Dept. Commerce, NOAA, NMFS, Special Scientific Report - Fisheries No. 621, 14 p.

Predation was studied during migration of the fry towards the Columbia River from two hatcheries – the Elokomin River Hatchery (13 km. upstream from the Columbia) and the Oxbow Hatchery on Herman Creek (0.2 km. upstream). In the Elokomin River the estimated loss of hatchery salmon to sculpins, Cottus spp., was 3.9 percent of 1.5 million fry released in 1962 and 1.3 and 3.6 percent of 2.2 and 0.1 million fry, respectively, released in 1963. Loss was negligible among 2.3 million fry released in Herman Creek in 1962. Sculpins that preyed on hatchery salmon were coastrange sculpin, C. aleuticus; prickly sculpin, C. asper; reticulate sculpin, C. perplexus, and torrent sculpin, C. rhotheus; in the Elokomin River and prickly and reticulate sculpins in Herman Creek. Predation was greatest by prickly sculpin (the largest species) and least by coastrange sculpin (a species with a comparatively small mouth). Losses of salmon to sculpins may have been related to diet and to the size of the releases. In the Elokomin River, predation was greater on salmon fed a wet diet than on those fed moist pellets. The larger of the two releases in 1963 had the smaller percentage loss. Improvement of hatchery procedures is probably the best way to reduce losses of hatchery-reared salmon to sculpins. (Auth.)

13198. Lux, F. E., and F. E. Nichy (Natl. Marine Fish. Serv. Biol. Lab., Woods Hole, Massachusetts). 1971. NUMBER AND LENGTHS, BY SEASON, OF FISHES CAUGHT WITH AN OTTER TRAWL NEAR WOODS HOLE, MASSACHUSETTS, SEPTEMBER 1961 TO DECEMBER 1962. U. S. Dept. Commerce, NOAA, NMFS, Special Scientific Report - Fisheries No. 622, 15 p.

Forty-one species of fish were caught in hauls made about four times per month at water depths of 2 to 15 feet (0.6 to 4.6 m.) in Woods Hole harbor. Seasonal occurrence is discussed and compared with water temperature. Data on growth during the first year are given for a number of species. (Authors)

13199. Etnier, David A. (Dept. of Zool. and Entomol., Univ. of Tennessee, Knoxville, Tennessee). 1971. FOOD OF THREE SPECIES OF SUNFISHES (Lepomis, Centrarchidae) AND THEIR HYBRIDS IN THREE MINNESOTA LAKES. Trans. Amer. Fish. Soc., 100(1): 124-128.

13200. Burkett, Robert D., and William B. Jackson (Dept. of Biol., Bowling Green State Univ., Bowling Green, Ohio). 1971. THE EYE LENS AS AN AGE INDICATOR IN FRESHWATER DRUM. Amer. Midl. Nat., 85(1): 222-225.

The eye lens weight of Aplodinotus grunniens was useful in determining annual age groups. A regression of scale age-lens weight data provided a method for approximating age of individuals, although some assessments would be misleading due to the overlap in lens weights between annual groups. In annual groups, neither sex had a mean lens weight larger than the other. Validity of the otolith technique for age determination was not demonstrated. (Authors)

13201. Baker, Myron Charles (Div. of Vert. Zool., Peabody Museum of Nat. Hist., New Haven, Connecticut). 1971. HABITAT SELECTION IN FOURSPINE STICKLEBACKS (Apeltes quadracus). Amer. Midl. Nat., 85(1): 239-242.

This study describes the range of microhabitats potentially available to fourspine sticklebacks (Apeltes quadracus) in a fresh-water stream. An experiment was performed to see if the fish could discriminate between one of the major components of its normal microhabitat, the plant Elodea canadensis, and another plant, Potamogeton praelongus, found in immediately adjacent microhabitats where these fish did not occur. Individuals were given trials of 20 min. in a test tank uniformly planted half with Elodea and half with Potamogeton. The fish showed a significant preference for Elodea under these conditions. (Auth.)

13202. Hanek, George, and William Threlfall (Dept. of Biol., Mem. Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1971. METAZOAN PARASITES OF THE TWOSPINE STICKLEBACK, Gasterosteus wheatlandi Putnam, 1867, IN NEWFOUNDLAND. Amer. Midl. Nat., 85(1): 275-276.

Metozoan parasites belonging to five genera (one of Monogenea; one of Digenea; two of Cestoda; one of Copepoda parasitica) were recovered from 60 specimens of the twospine stickleback Gasterosteus wheatlandi Putnam, 1867, caught at three localities in Newfoundland during the period December 1968 - June 1969. (Authors)

13203. Chau, Yiu-Kee, and Hirohumi Saitoh (Canada Centre for Inland Waters, Burlington, Ontario, Canada). 1970. DETERMINATION OF SUBMICROGRAM QUANTITIES OF MERCURY IN LAKE WATERS. Environmental Science & Technology 4, No. 10, pp. 839-841; Commercial Fisheries Abstracts, 24(2): p. 19.

This article describes a simple and sensitive method for the determination of submicrogram quantities of mercury in lake water using a combination of concentration of the mercury by dithizone extraction and atomic absorption of mercury vapor. The mercury is extracted from the water with dithizone (dissolved in chloroform), back extracted (to transfer the mercury from the chloroform phase back to an aqueous phase) by hydrochloric acid, then converted to vapor by a reduction-aeration reaction (using stannous chloride and the modified closed-system aeration technique of Hatch and Ott, 1968). The extraction method removes Hg, Hg_2^{2+}, and some organomercuric compounds. Details of the apparatus used and the reagents are given. The method was sensitive to 0.008 μg. per liter (0.008 p.p.b.). The standard deviation for a lake water sample containing 0.478 μg. of mercury per liter of water was 0.0087, and for a lake water sample containing 0.0048 μg. of mercury per liter it was 0.0042.

13204. Ogino, Chinkichi, Takeshi Watanabe, Jun Kakino, Noriyuki Iwanaga, and Masanori Mizuno (Lab. of Fisheries Biochem., Tokyo Univ. of Fisheries, Konan 4, Minato-ku, Tokyo, Japan). 1970. B VITAMIN REQUIREMENTS OF CARP -- III. REQUIREMENT FOR BIOTIN. Bull Jap. Soc. Sci. Fish., 36(7): 734-740; Commercial Fisheries Abstracts, 24(2): p. 22.

The requirement of young carp for biotin (as determined by weight gain and content of biotin in the hepatopancreas) is 0.1 mg per 100 g. of the diet or 0.02-0.03 mg. per kg. of weight per day.

13205. Smith, John Warren, and Sotirios G. Grigoropoulos (Esso Res. & Eng. Co., Florham Park, New Jersey). 1970. TOXIC EFFECTS OF TRACE ORGANICS ON FISH. Chem. Abstracts, 73(18): 91024g; Commercial Fisheries Abstracts, 24(2): p. 26.

13206. Suzuki, Tsuneyoshi (Fac. of Fisheries, Hokkaido Univ., Japan). 1970. SWIMMING BEHAVIOUR OF CHUM SALMON IN THE SOUTHEASTERN AREA OFF KAMCHATKA PENINSULA. Bull. Jap. Soc. sci. Fish., 36(1): 19-25. In Japanese, tables and figures in English.

In order to investigate differences in the swimming behaviour of salmon between the early morning and night, observations were carried out on board the Arisomaru of the Fisheries Agency, Ministry of Agriculture, Japanese Government, in the southeastern area off Kamchatka Peninsula from June 10 to July 26, 1968. Two sets of surface gillnet were set at right angles to each other, following a southeastern direction parallel to Kamchatka Peninsula. The time duration of the net set was about two hours; one net was set approximately at midnight (night net), and the other one hour after sunrise (morning net) at the same place. The chum salmon caught proved to be mainly 4 years old, exclusively adults, belonging to the west coast population of Kamchatka Peninsula. Chum salmon caught by the night net were almost even with regard to directions. In the case of morning net the catches increased both in southeastern and northeastern directions, coinciding with the migrating direction of this species. As for the difference between the night catch and the morning one, no special biological differences were observed in age composition, sex ratio, gonad weight and volume of stomach contents, etc. of this fish.

13207. Hirayama, Kazutsugu (Fac. of Fisheries, Nagasaki Univ., Nagasaki, Japan). 1970. STUDIES ON WATER CONTROL BY FILTRATION THROUGH SAND BED IN A MARINE AQUARIUM WITH CLOSED CIRCULATING SYSTEM - VI. ACIDIFICATION OF AQUARIUM WATER. Bull. Jap. Soc. sci. Fish., 36(1): 26-34. (In English).

Studies were made on acidification of the culture water in marine aquariums with closed circulating system in connection with the conditions of culturing fishes. The acidifying velocity of aquarium water is not affected by the variation in grain size of the filter sands. The relation between the acidifying velocity of aquarium water (V eq./day) and the feeding rate (F g/day) can be represented by the following equation. $V = 0.92\ F \times 10^{-3}$. The variation of body weight of fish cultured in an aquarium as compared with that of the feeding rate may not bring any significant difference in the acidifying velocity of the aquarium water. The nitrifying ability of aquarium filter is exhibited well enough to keep ammonium-N at a low level even if the pH value becomes under 7.0. Nitrification never ceases completely even if acidification ceases at the pH value under 4.8 and the alkalinity value of nearly 0 meq./l. The low values of pH and alkalinity hardly bring any harmful influence on cultured fish and so far as both values remain within a low level, ammonium-N accumulated in the sea water brings forth little influence. A proper amount of $CaCO_3$ such as coral and shell put in the aquarium, can maintain the value of pH and alkalinity over 7.5 and 1.0 meq./l, respectively, and its preventive effect on acidification of the culture water is distinctly due to the dissolution of calcium.

13208. Uchiyama, Hitoshi, Shigeo Ehira and Nobukuni Tsuchiya (Tokai Reg. Fish. Res. Lab., Tokyo, Japan). 1970. EXTRACTION OF NUCLEIC ACIDS IN FISH MUSCLE AND LIVER WITH PHENOL. Bull. Jap. Soc. sci. Fish., 36(1): 74-82. (In English).

The nucleic acids have been extracted from the muscle and liver of fish with phenol. The RNA and DNA were found to be concentrated in the aqueous phase separated from the phenol layer and extracted in an "undegraded" form by using nuclease inhibitors such as bentonite and potassium polyvinylsulphate throughout the procedure. As was the case of nucleic acids from Bacillus subtilis spores or Escherichia coli strain B, the chromatography of the nucleic acids thus extracted on methylated bovine serum albumine kieselgur column gave the three peaks, s-RNS, DNA and r-RNA. The two r-RNA subunits from skipjack muscle and liver were easily resolved on the column as well as those of spores r-RNA, whereas the plaice muscle r-RNA was not. The method described here is considered to be applicable for the extraction of nucleic acids in "undegraded" form from the muscle and liver of fish.

13209. Asakawa, Makio (Lab. Fish. Tech., Fac. Agr., Kyushu Univ., Fukuoka, Japan). 1970. HISTOCHEMICAL STUDIES OF THE MUCUS ON THE EPIDERMIS OF EEL, Anguilla japonica. Bull. Jap. Soc. sci. Fish., 36(1): 83-87. (In Japanese).

In the present paper, to elucidate the chemical nature and property of fish mucus, histochemical identification and characterization were first performed on the mucus in the epidermis of the eel, Anguilla japonica. The tissue was fixed in Carnoy's fluid for about 1 hour, and then cut at a thickness of 10 μ. The sections were stained by the conventional periodic-acid-Schiff (PAS) reaction for polysaccharides. For sialic-acid-containing glycoproteins, alcian blue (AB)-PAS staining with or without sialidase digestion was carried out. For sulfated mucopolysaccharides, aldehyde fuchsin (AF)-AB, AB-safranin 0 (Saf.), and neutral red (NR) staining were done. The mucin covering the eel body was composed mainly of sialic-acid-containing glycoprotein and sulfated mucopolysaccharide. The former is secreted to the outside from goblet cells, the latter from columnar mucous cells, respectively. The predominant component of the mucus seems to be sialic-acid-containing glycoprotein.

13210. Honma, Shinji, and Yoshiharu Honma (Dept. of Physiol., Niigata Univ., School of Medicine, Niigata, Japan). 1970. HISTOCHEMICAL DEMONSTRATION OF MONOAMINES IN THE HYPOTHALAMUS OF THE LAMPREYS AND ICE-GOBY. Bull. Jap. Soc. sci. Fish., 36(2): 125-134. In English.

Histochemical examination by means of fluorescence microscope was performed in order to ascertain the distribution of monoamines in the hypothalamus of two widely separated groups, i. e., two species of the lampreys and the ice-goby, from phylogenetic and ontogenetic points of view. In the brains of both mature river and adult brook lampreys, the fluorescent area was disclosed around the recessus posterior, which further extends rostrally to the lateral wall of the neurohypophysial recessus, i. e., the recessus infundibuli. This fluorescence located in the periventricular area consisted of the cells appearing in the flame-bulb. By examination of the specimens treated with reserpin and sodium borohydride, the fluorescent substance contained in the cells of lamprey seemed to be the monoamines. The fluorescence is also recognized in the hypothalamic region of ice-goby, which might correspond to the nucleus recessus lateralis hypothalami and nucleus recessus posterioris hypothalami. No fluorescent cells and fibers were demonstrated in the hypophysis and hypothalamic neurosecretory cells of both lampreys and ice-goby.

13211. Wakabayashi, Hisatsugu, Keiko Kira, and Syuzo Egusa (Dept. of Fishery, Fac. of Agr., Univ. of Tokyo, Tokyo, Japan). 1970. STUDIES ON COLUMNARIS DISEASE OF POND-CULTURED EELS - I. CHARACTERISTICS AND PATHOGENICITY OF Chondrococcus columnaris ISOLATED FROM POND-CULTURED EELS. Bull. Jap. Soc. sci. Fish., 36(2): 147-155. (In Japanese, tables in English).

Since 1966, gill disease has been associated with serious mortality of pond-cultured eels during the summer months in many eel farms in Shizuoka prefecture. The disease was characterized by partial or extended losses of gill filaments and the occurrence of yellowish colonies of Chondrococcus-like bacteria on the gill surface. The cultures isolated from gill lesions were long flexible Gram-negative rods, which showed the movements and columnar formation peculiar to Chondrococcus columnaris. The formation of fruiting bodies and the production of microcysts were observed in the cultures maintained by Borg's method. The organism was therefore identified as Chondrococcus columnaris (Davis) Ordal and Lucker (1944). The biochemical characteristics of the organism were in full accord with those of C. columnaris isolated from Japanese loaches. The organism was occasionally isolated from skin lesions and the kidney of diseased fish. Eels were experimentally exposed to five strains of C. columnaris by means of pouring the broth cultures on the gill surface. Two preliminary experiments suggested that the pathogenicity of the organism might differ markedly with strains. The same was perceived in the following experiments using three other strains. In these experiments use was made of well-fed, fat-, and starved, thin fish, in which the opercula were removed and the surface of the gills on one side was lightly brushed

with a toothbrush prior to the experimentation. In the three strains typical yellowish colonies appeared on the gill two to three days after the exposure, and parts of the gill gilaments began to degenerate and finally gill lesions of the same type as those that naturally occur were produced. Occasionally colonies which had developed on the gill disappeared in the course of time. Mechanical injuries on the gill surface did not necessarily facilitate the infection of the organism. The lethality of the organism to the eel varied considerably with the strain. As compared with fat fish, starved, thin fish seemed to be more resistant to the attack of the organism.

13212. Yoshida, Yoichi (Dept. Fish., Fac. Agr., Kyoto Univ., Maizuru, Japan). 1970. STUDIES ON THE EFFICIENCY OF FOOD CONVERSION TO FISH BODY GROWTH - I. THE FORMULAE ON THE EFFICIENCY OF CONVERSION. Bull. Jap. Soc. sci. Fish., 36(2): 156-159. (In Japanese, figures in English).

A formula to determine the efficiency of food conversion to fish body growth was examined in order to advance the formulae on the growth of fish which had been shown in the previous paper. As results of the experiments, the following formulae and others were obtained. The formula on the relation between efficiency of conversion (X) and body weight (W) is:

$$X = \frac{\beta}{\delta\beta'} - \frac{\gamma}{\delta\beta'} W^{\frac{1}{3}}.$$

The formula on the relation between the rate of increase in weight (Y) and the rate of food uptake (Z) is:

$$Y = \frac{\beta}{\delta\beta'} Z - \frac{\gamma}{\delta}.$$

δ is the energy per unit weight used for construction of the increased portion of body, and δ, β', β, and γ are constants.

13213. Yoshida, Yoichi (Dept. Fish., Fac. Agr., Kyoto Univ., Maizuru, Japan). 1970. STUDIES ON THE EFFICIENCY OF FOOD CONVERSION TO FISH BODY GROWTH - II. THE APPLICATION OF THE FORMULAE TO THE EFFICIENCY OF CONVERSION IN BREEDING FISHES. Bull. Jap. Soc. sci. Fish., 36(2): 160-164. (In Japanese, figures and tables in English).

The application of the formulae to determine the efficiency of conversion in some samples of breeding fishes was attempted. It was ascertained that the formulae were pretty well applicable if under constant breeding conditions and growth stage. Further, the following formulae which can be applied to different growth stages are proposed as general formulae. The formula on the relation between efficiency of conversion (X) and body weight (W) is:

$$X = \frac{\beta}{\delta\beta'} - \frac{\gamma}{\delta\beta'} W^{n-m}.$$

The formula on the relation between the rate of increase in weight (Y) and the rate of food uptake (Z) is:

$$Y = \frac{\beta}{\delta\beta'} Z - \frac{\gamma}{\delta} W^{n-1}.$$

δ, β', β, γ, m, and n are constants.

13214. Takashi, Reiji, Ken-ichi Arai, and Tsuneyuki Saito (Lab. of Biochem., Fac. of Fisheries, Hokkaido Univ., Hakodate, Japan). 1970. STUDIES ON MUSCULAR PROTEINS OF FISH - I. PREPARATION OF MYOSIN FROM CARP MUSCLE. Bull. Jap. Soc. sci. Fish., 36(2): 165-168. (In Japanese, tables and figures in English).

An attempt has been made to prepare myosin from carp muscle by using the original method of Connell (1960). The preparative method mostly used is as follows: the coarsely minced dorsal muscle of carp was washed 3 times in cold with a phosphate buffer, pH 7.5, I = 0.05 in order to remove the sarcoplasmic proteins, and the residue was then extracted by slow stirring for 7 min. with 3 volumes of 0.47 M KCl-49mM KH_2PO_4-17.6mM Na_2HPO_4-5mM $MgCl_2$-5mM ATP of pH 6.4. Such extracted solution was diluted by the slow addition of 10 volumes of water. The precipitated myosin was collected, dissolved and dialyzed against 0.6 M KCl of pH 6.8. Myosin prepared by the above method showed all the typical properties of myosin as already known in the case of rabbit; that is, active ATP hydrolyzing activity, low ATP-sensitivity (7-15), negative superprecipitation reaction, and low viscosity compared to those of actomyosin.

13215. Wickham, Donald A., Jimmy B. Cagle, and Frank Hightower, Jr. (NMFS, Exploratory Fishing & Gear Res. Base, Pascagoula, Mississippi). 1971. APPARATUS FOR CONTROLLING AMBIENT LIGHT CYCLES IN EXPERIMENTAL ENVIRONMENTS. Trans. Amer. Fish. Soc., 100(1): 128-131.

13216. Takashi, Reiji, Ken-ichi Arai, and Tsuneyuki Saito (Lab. of Biochem., Fac. of Fisheries, Hokkaido Univ., Hakodate, Japan). 1970. STUDIES ON MUSCULAR PROTEINS OF FISH - II. PREPARATION OF ACTOMYOSIN FROM CARP MUSCLE. Bull. Jap. Soc. sci. Fish., 36(2): 169-172. (In Japanese, figures and tables in English).

An attempt has been made to prepare actomyosin from carp muscle using the original method of Connell (1960). The preparative method mostly used is as follows: the coarsely minced dorsal muscle of carp was washed 3 times in cold with a phosphate buffer, pH 7.5, I = 0.05, in order to remove the sarcoplasmic proteins, and the residue was then extracted by slow stirring for periods of 7 min., 2 hours and 20 hours with 3 separate volumes of 0.45 M KCl-3.38mM KH_2PO_4-15.5mM Na_2HPO_4 of pH 7.5. Such extracted solution was diluted by the slow addition of 10 volumes of water. The precipitated protein was collected, dissolved and dialyzed against 0.6 M KCl, pH 6.8. The properties of actomyosin was observed to be not influenced by the different periods of extraction with 0.45 M KCl-phosphate buffer of pH 7.5. Actomyosin prepared by the above method showed all the typical properties of actomyosin as already known in the case of rabbit; that is, active ATP hydrolyzing activity, high ATP-sensitivity (125-140), positive superprecipitation reaction, and anomalous viscosity.

13217. Harada, Katsuhiko, Shigetsugu Miura, Yoshio Shinoda, and Kinjiro Yamada. (The Shimonoseki Univ. of Fisheries, Shimonoseki, Japan). 1970. THIN-LAYER CHROMATOGRAPHIC IDENTIFICATION OF FORMALDEHYDE IN AQUATIC ANIMALS. Bull. Jap. Soc. sci. Fish., 36(2): 188-191. (In Japanese, figures and tables in English).

A convenient method, based on thin-layer chromatographic procedures, was developed to identify formaldehyde which circumstantially occurs in aquatic animals. In the experiments described, the formaldehyde in muscle was extracted with petroleum ether after converting it into 2,4-dinitrophenylhydrazone. The extract was then evaporated to dryness and the residue was re-extracted with a small volume of toluene. The final extract was then applied on activated silica gel G plates, and developed with a solvent consisting of hexane-ethanol-acetic acid (90:10:3). The confirmatory evidence of formaldehyde in muscle was obtained from parallel experiments conducted with authentic 2,4-dinitrophenyl-hydrazones of C_1- and C_2-alkanals. The presence of formaldehyde in muscle of fish and other aquatic animals was successfully confirmed by the adapted method, and it was found that the aldehyde exists in all of the muscles so far as examined except in the cyprinid, Carassius auratus.

13218. Haga, Yoshiko, Hideo Haga, Tokiko Hagino, and Teiji Kariya (Dept. Fish. Fac. Agr. Tohoku Univ., Kita-6 Sendai, Japan). 1970. STUDIES ON THE POST-MORTEM IDENTIFICATION OF THE POLLUTANT IN FISH KILLED BY WATER POLLUTION - XII. ACUTE POISONING WITH MERCURY (1). Bull. Jap. Soc. sci. Fish., 36(3): 225-231. (In Japanese, figures and tables in English).

An attempt was made to detect mercury in the body of fish killed by inorganic mercury in solution ($HgCl_2$). The total mercury was determined by the Dithizone-Carbontetrachloride method. The 48 hour median tolerance limit of $HgCl_2$ for goldfish (Carassius auratus) lay between 1-0.5 ppm Hg, and 5 ppm Hg was found to be fatal to goldfish in about 10 hours. Mercury content of control fish ranged 0.14-0.36 γ/g Hg. The bodies of fish killed by various concentrations of $HgCl_2$ showed values higher than 2.3 γ/g Hg, while those living in 0.5 ppm Hg solution for 48 hours showed 1.2-1.8 γ/g Hg. Goldfish died in 0.5 ppm Hg solution within 6 or 7 days, and 2.3-4.6 γ/g Hg was detected from the dead fish. When the body of fish killed by mercury poisoning was washed with running tap water for 24 hours after death, the mercury content of the body decreased to about 18.2-50.7%. The distribution of mercury in seven parts of fish body was examined in two cases. In the first case, the fish was killed by Hg in solution, and in the second case, the fish was soaked in Hg solution after death from suffocation. In the former, gill always showed the highest value and kidney came next. In the latter, however, mercury content showed low values in every part examined. It is interesting to

note that mercury was scarcely detected in spleen and kidney in the latter case. Some species of aquatic animals in the Abukuma and the Hirose-Natori Rivers were tested for mercury content to find the distribution of mercury in the natural aquatic environment. The maximum value of mercury content was 3.72 γ/g Hg in Zacco platypus. Almost all species, however, showed values lower than 1 γ/g Hg. This means that there was no possibility of mercury pollution in both rivers.

13219. Arai, Ken-ichi, Reiji Takashi, and Tsuneyuki Saito (Lab. of Biochem., Fac. of Fisheries, Hokkaido Univ., Hakodate, Japan). 1970. STUDIES ON MUSCULAR PROTEINS OF FISH -IV. ON THE ATP-SENSITIVITY OF ACTOMYOSIN AND MYOSIN OBTAINED FROM CARP MUSCLE. Bull. Jap. Soc. sci. Fish., 36(3): 237-240. (In Japanese, figures in English).

Fundamental studies on the viscosity of carp muscular proteins were made to evaluate their ATP-sensitivity. Although the viscosity of carp actomyosin and myosin is 0.6 M KCl, pH 6.8, varied slightly from preparation to preparation, it was found that there was a proportionality between the protein concentration (C) and the logarithms of relative viscosity ($\log \eta_r$) before and after the addition of ATP and $MgCl_2$. Because the viscosity numbers ($\log \eta_r/C$), with and without ATP, were independent of their protein concentrations, namely a constant independent of concentration, the ATP-sensitivity was evaluated. Therefore, it was recognized that the characterization of actomyosin and myosin by means of the ATP-sensitivity test can successfully be applied to carp muscle. The ATP-sensitivity is defined as $\frac{Z\eta_r - Z\eta_{r.ATP}}{Z\eta_{r.ATP}} \times 100$ Portzehl et al. where $Z\eta_r$ and $Z\eta_{r.ATP}$ are the viscosity numbers before and after the addition of ATP respectively.

13220. Ogino, Chinkichi, and Kunio Saito (Tokyo Univ. of Fisheries, Konan 4, Minato-ku, Tokyo, Japan). 1970. PROTEIN NUTRITION IN FISH - I. THE UTILIZATION OF DIETARY PROTEIN BY YOUNG CARP. Bull. Jap. Soc. sci. Fish., 36(3): 250-254. (In Japanese, figures and tables in English).

Feeding experiments lasting 30 days have been carried out with diets containing varying levels of casein to determine the utilization of dietary protein by young carp. Within a range of 0.4 to 55.0% of crude protein in the diet, the increase in body weight was in proportion to the content of protein, whereas the accumulation of protein in the body was found to reach the definite value when the crude protein level in the diet was close to 38%. From these results, it is considered that the mode of weight gain and protein accumulation by carp is considerably different at higher levels of protein in the diet. The protein accumulation rate (protein accumulated/protein consumed) showed its highest value at near 21% of protein level, while the protein utilization value (protein accumulation rate x protein content of diet) attained its highest value at 38% of protein level. These results show that the requirement of young carp for dietary protein is about 38% of protein in the diet; when casein is used as the sole protein source. The relationships between the protein content of the diet and the conversion factor, feed efficiency, protein efficiency ratio (PER) and net protein utilization (NPU) were determined.

13221. Kitamikado, Manabu, and Hiroshi Yamamoto (Lab. Fish. Tech., Fac. Agr., Kyushu Univ., Fukuoka, Japan). 1970. ACTION MECHANISM OF FISH GASTRIC HYALURONIDASE. Bull. Jap. Soc. sci. Fish., 36(4): 385-390. (In English).

Hyaluronidase of crude extract from mackerel gastric mucosa was concentrated by ammonium sulfate precipitation and Sephadex G-100 filtration up to about 30 fold purity. This purified preparation was completely free from β-glucoronidase. Analysis of the reaction products demonstrated that the principal products by the preparation were a series of even numbered oligosaccharides which have N-acetylhexosamine end group, and this enzyme was a β-endo-N-acetylhexosaminidase. Transglycosylation activity of the preparation was also demonstrated by the fact that the higher oligosaccharide was produced by the action of the enzyme on tetra- or hexasaccharide.

13222. Shirota, Akihiko (Internaltional Organization: Southeast Asian Fish. Development Center, Changi Point, Singapore, Malayasia). 1970. STUDIES ON THE MOUTH SIZE OF FISH LARVAE. Bull. Jap. Soc. sci. Fish., 36(4): 353-368. (In Japanese, figures and tables in English).

The author measured the mouth size of various larval fishes, which had absorbed their yolk and just begun to take natural live food, and studied the relationship between mouth size, food size and growth. Total body length of these fishes ranged from 10 to 20 mm. No definite relationship was found between mouth size and total body length at the time of commencement of feeding. The mouth size of various larval fishes at the time of commencement of feeding ranged from 200 μ to 1,000 μ and was observed to have a close relationship to the size of their natural foods: That is, larval fishes having small mouth size, such as Hypomesus, Plecoglossus, Ammodytes, Sillago, Konosirus and Oplegnathus take only phytoplankton, protozoa and the nauplii of small copepods, but larval fishes having big mouth size, such as Thunnus, Katsuwonus, Seriola, Girella, Mugil, Lateolabrax and Clupea were found to easily take large copepods at the time of commencement of feeding. Although the body size at the time of commencement of feeding, in fishes of rapid growth such as Thunnus, Katsuwonus, Seriola and Scomber, was much smaller (about 1/2) than that of Clupea, their mouth size was equal to or larger than that of Clupea. It was made clear that the quicker the growth of fish, the greater is the mouth size at the time of commencement of feeding.

13223. Aoe, Hiroshi, Isao Masuda, Isao Abe, Takeshi Saito, Toshiko Toyoda, and Sasaburo Kitamura (Central Lab. of Nisshin Flour Milling Co., Saitama, Japan). 1970. NUTRITION OF PROTEIN IN YOUNG CARP - I. NUTRITIVE VALUE OF FREE AMINO ACIDS. Bull. Jap. Soc. sci. Fish., 36(4): 407-413. (In English).

In repeated feeding experiments, amino acid diets after the formulae for salmonoid fishes and for channel catfish were found to be unable to sustain the growth of young carp. The hydrolyzates of casein after treatment with trypsin could not replace casein itself. A higher level of cellulose flour or agar-agar was effective in controlling the retention time of amino acid test diet in the intestine to the extent of that of the casein-gelatin test diet, but the growth of young carp was not improved at all. These results suggest that there is a specific aspect in the protein nutrition of young carp.

13224. Umemoto, Shigeru, and Koichi Kanna (Tokai Reg. Fish. Res. Lab., Kachidoki, Chuo-ku, Tokyo, Japan). 1970. STUDIES ON GEL FILTRATION OF FISH MUSCLE PROTEIN - III. ELUTION PATTERNS OF PROTEIN EXTRACTS FROM FISH AND RABBIT MUSCLE BY GEL FILTRATION USING SEPHAROSE 2B. Bull. Jap. Soc. sci. Fish., 36(4): 414-420. (In Japanese, figures and tables in English).

The extractability of muscle protein is used as an index of protein denaturation or insolubilization which may take place in frozen fish muscle. Furthermore, the protein extractability, namely the extracted protein composition, seems to be a useful index for tracing the course and progress of protein denaturation in fish muscle. In the previous paper, it was reported that fish muscle proteins were eluted separately in actomyosin (and/or aggregates), myosin and myogen by gel filtration using agarose gels which have very high porosity. To know the composition of the extractable proteins contained in fresh muscle, gel filtration and ultracentrifugal analysis of fresh muscle protein extracts were carried out. Samples used were muscle protein extracts with KCl-phosphate buffer solution (I = 0.5, pH 7.2), prepared from sea bass, Lateolabrax japonicus (Cuvier), yellowtail, Seriola quinqueradiata Temminck and Schlegel. Two peaks, contributed by actomyosin and myogen, were observed in the elution patterns by gel filtration of fresh fish muscle protein extracts in both (1) a brief time extraction (ca. 1 hour) and also (2) a prolonged time extraction (1 day). However, for fresh rabbit muscle, peaks of myosin and myogen were observed in the elution pattern of the muscle extract in brief time extraction, and peaks of actomyosin and myogen in the prolonged time extraction. The results of ultracentrifugation supported the above-mentioned results obtained by gel filtration. These elution patterns of muscle protein extracts

by gel filtration also showed rough profiles of protein composition of the extracts and the results indicate that changes in elution patterns may give some useful information on changes in composition of extractable muscle protein.

13225. Kashiwada, Ken-ichi, Shin-ichi Teshima, and Akio Kanazawa (Fac. of Fish., Kagoshima Univ., Kagoshima City, Japan). 1970. STUDIES ON THE PRODUCTION OF B VITAMINS BY INTESTINAL BACTERIA OF FISH - V. EVIDENCE OF THE PRODUCTION OF VITAMIN B_{12} BY MICROORGANISMS IN THE INTESTINAL CANAL OF CARP, Cyprinus carpio. Bull. Jap. Soc. sci. Fish., 36(4): 421-424. (In English).

After cultivating carp with several test diets for 10 days, the amount of B_{12} in the intestinal contents was determined by the micro-bioassay method using Lactobacillus leichmannii. A considerable amount of B_{12} was observed in the intestinal contents of the fish fed on B_{12}-free diets. Moreover, a remarkable increase of B_{12} was observed when the excised intestinal canal was incubated in vitro for 6 hours at 25°C. The addition of sulfanylamide to the diet did not always cause the decrease of B_{12} in the intestinal contents. These results indicate the production of B_{12} by microorganisms in the intestinal canal of carp.

13226. Yamashita, Hideo (Seikai Reg. Fish. Res. Lab., Nagasaki, Japan). 1970. BLOOD CHARACTERISTICS OF MARINE FISH IN RELATION TO THE CHANGE OF OSMOTIC PRESSURE OF SEA WATER - I. CHANGES OF OSMOTIC PRESSURE OF SERUM AND THE ELECTROPHORETIC PATTERN OF THE SERUM PROTEIN OF ROCKFISH. Bull. Jap. Soc. sci. Fish., 36(5): 439-449. (In English).

Thirty-four females and 27 males of a species of rockfish, Sebastiscus marmoratus, were kept in tanks of circulating sea water from March 15 to 28, 1968. They were acclimatized to three series of osmotic pressure changes. The changes of the osmotic pressure of serum and serum protein fractions derived from electrophoresis were compared for each series. A close linear relation was observed, with a correlation coefficient of +0.84, between the osmotic pressure of sea water and its chlorinity. No correlation was observed between the osmotic pressure of rockfish serum and that of the sea water of the experimental tank. A positive correlation was observed between the specific gravity of blood and haematocrit. However, no correlation was obtained between the specific gravity and the amount of serum protein, and also between haematocrit and the amount of serum protein. Each electrophoretic fraction of serum protein, I, II, III and IV plus V, in specimens kept in natural sea water with about 1040 mOsm/kg showed almost no difference as compared with those of the normal pattern. However, component IV plus V increased with the lowering and raising of the osmotic pressures of sea water, whereas components I, II and III scarcely varied.

13227. Yamashita, Hideo (Sekai Reg. Fish. Res. Lab., Nagasaki, Japan). 1970. BLOOD CHARACTERISTICS OF MARINE FISH IN RELATION TO THE CHANGE OF OSMOTIC PRESSURE OF SEA WATER - II. CHANGE OF OSMOTIC PRESSURE OF SERUM AND THE ELECTROPHORETIC PATTERN OF THE SERUM PROTEIN OF YOUNG YELLOWTAIL. Bull. Jap. Soc. sci. Fish., 36(5): 450-454. (In English).

Eight individuals of young yellowtail were acclimatized to various degrees of osmotic pressure of sea water to analyze the change of their blood characteristics, the electrophoretic pattern of their serum protein and the osmotic pressure of serum. When acclimatized to sea water with the osmotic pressure ranging from 693.3 to 1173.9 mOsm/kg, the osmotic pressure of the serum ranged from 364.0 to 386.2 mOsm/kg. A linear relationship was found between both osmotic pressures with a high correlation coefficient: 0.997. The electrophoretic pattern of serum protein of this species clearly separated into 4 components. In a high osmotic pressure of water, 1173.9 mOsm/kg, component I decreased and component IV increased as compared with those of control specimens. The osmotic fragility of erythrocyte decreased when the specimens were acclimatized to water of low osmotic pressure. On the contrary this fragility gave high values when the specimens were acclimatized to a higher osmotic pressure of water.

13228. Arai, Ken-ichi, Reiji Takashi, and Tsuneyuki Saito (Lab. of Biochem., Fac. of Fish., Hokkaido Univ., Hakodate, Japan). 1970. STUDIES ON THE MUSCULAR PROTEINS OF FISH - V. ON THE SUPERPRECIPITATION OF ACTOMYOSIN FROM CARP MUSCLE. Bull. Jap. Soc. sci. Fish., 36(5): 487-490. (In Japanese, figures in English).

It is a well-known characteristic of actomyosin, the contractile muscle protein, to undergo superprecipitation at low ionic strength when a low concentration of ATP is added. Attempts at superprecipitation to discriminate the actomyosin from the myosin, prepared from carp dorsal muscle in the laboratory, were successful while both actomyosin and myosin retained their active ATP hydrolyzing activity. Observation of superprecipitation was made at protein concentrations of 0.8 - 1.0 mg/ml in 0.10 M KCl by the addition of ATP to a final concentration of 1 mM.

13229. Ehira, Shigeo, Hitoshi Uchiyama, Fumiaki Uda, and Hiroyuki Matsumiya (Tokai Reg. Fish. Res. Lab., Tokyo, Japan). 1970. A RAPID METHOD FOR DETERMINATION OF THE ACID-SOLUBLE NUCLEOTIDES IN FISH MUSCLE BY CONCAVE GRADIENT ELUTION. Bull. Jap. Soc. sci. Fish., 36(5): 491-496. (In English).

By introducing a concave gradient elution system with increasing sodium chloride concentration and decreasing pH, the column chromatographic method for determination of nucleotides and related compounds in fish muscle was simplified. HxR+Hx, IMP, AMP, ADP, and ATP can be separated completely from each other within 3 hrs and the recoveries are satisfactory. The distribution pattern of these compounds in the muscles of yellowtail, Pacific cod and fan shell was examined by the improved method.

13230. Haraguchi, Tatsuichi, and Masahide Iimori (Lion Fat and Oil Co., Ltd, Hirai, Edogawa-ku Tokyo, Japan). 1970. CLEANING OF FISH WITH SURFACE ACTIVE AGENTS. Bull. Jap. Soc. sci. Fish., 36(5): 497-501. (In Japanese, figures and tables in English).

The cleaning effect on jack mackerel (Trachurus trachurus) was examined with different surface-active agents, such as sodium linear alkylbenzene sulfonate (LAS), sucrose fatty acid ester (SE), and polyoxyethylene (9) fatty alcohol (C_{16-18}) ether (PEFA). The surface active agents were dissolved in phosphate-citric acid buffer of different pH values. Cleaning of fish with PEFA and LAS at pH 5.0 resulted in a clean surface appearance and the removal of unpleasant fishy odour. But the skin surface treated with LAS turned buff color within 1-2 days after cleaning. Viable bacterial counts on the skin surface decreased to 1/100 - 1/1000 after cleaning with PEFA solution at pH 5.0. No other surface active agents tested showed similar effect.

13231. Tokunaga, Toshio (Tokai Reg. Fish. Res. Lab., Kachidoki, Chuo-ku, Tokyo, Japan). 1970. TRIMETHYLAMINE OXIDE AND ITS DECOMPOSITION IN THE BLOODY MUSCLE OF FISH - I. TMAO, TMA, AND DMA CONTENTS IN ORDINARY AND BLOODY MUSCLES. Bull. Jap. Soc. sci. Fish., 36(5): 502-509. (In Japanese, figures and tables in English).

A number of quantitative determinations of TMAO have been reported on various fish species of both freshwater and marine origin but very little is known about the comparative aspects of the TMAO content between the ordinary and bloody muscles of fish. The author, therefore, carried out the measurement of TMAO, TMA and DMA in the bloody and ordinary muscle parts of 16 species of fish and the findings are as follows: In the varieties of so-called dark-fleshed fish such as mackerel, sardine, skipjack, etc., the bloody muscles were rich in TMAO content, while in the ordinary muscles the TMAO content was poor and variable. In white-fleshed fish such as seabass, Japanese gurnard and others the TMAO content was much higher in the ordinary muscle than in the bloody muscle. With the exception of saury and gadoid fish, the TMAO-N content in the bloody muscle indicated less variable levels within a range of 20 to 40 mg%, among the species of fish tested. In each fish examined, the amount of TMA detected in the bloody muscle was larger than that in the ordinary muscle. Although a very small quantity of DMA was found

in the ordinary muscle of some kinds of fish, larger quantities of DMA were always observed in the bloody muscle of all species examined. Formaldehyde was also detected in the bloody muscle whenever DMA was obviously found, and this fact may suggest a possible existence of enzyme(s) capable of forming DMA and formaldehyde from TMAO in the bloody muscles of a rather wide variety of fish.

13232. Akiyama, Akio (Dept. of Biol., Sci. Div., Toho Univ., Chiba, Japan). 1970. ACUTE TOXICITY OF TWO ORGANIC MERCURY COMPOUNDS TO THE TELEOST, Oryzias latipes, IN DIFFERENT STAGES OF DEVELOPMENT. Bull. Jap. Soc. sci. Fish., 36(6): 563-570. (In English).

The differential susceptibility of eggs, developing embryos, fry and adult of a cypridont fish, Oryzias latipes, have been studied on the base of the 24-hour Median Tolerance Limit to the organic mercury compounds, phenylmercuric acetate and metoxyethylmercuric chloride. The aliphatic organic mercury, metoxyethylmercuric chloride was less toxic than the aromatic organic mercury, phenylmercuric acetate. To metoxyethylmercuric chloride, 24 hour TLm for eggs, fry and adult was 0.50-1.30 ppm, 1.48 ppm and 1.74 ppm respectively, while to phenylmercuric acetate, 0.18-0.26 ppm, 0.03 ppm and 0.21 ppm respectively. Adult fish were more tolerant to all toxicants than fry, but eggs in the solution of PMA were most resistant. In developing embryos, 24 hour TLm to the organic mercury compounds gradually increased through the early stage, passed through a maximum in the median phase at 5 days of age, and finally fell off in the later phase to a general minimum. With the process of growth of the fish, 24 hour TLm increased logarithmically. A straight line is well fitted when log TLm (Y in ppm) is plotted against age (X in days) of the fish. The regression equation was,

$$\log Y = 0.0050X - 1.4018$$

and significant in the level of P = 0.01 and regression coefficient ranged from 0.0016 to 0.0084.

13233. Itazawa, Yasuo (Dept. of Fish., Fac. of Agr., Kyushu Univ., Fukuoka, Japan). 1970. CHARACTERISTICS OF RESPIRATION OF FISH CONSIDERED FROM THE ARTERIO-VENOUS DIFFERENCE OF OXYGEN CONTENT. Bull. Jap. Soc. sci. Fish., 36(6): 571-577. (In English).

Arterial and venous level of oxygen content were determined with normal fish of three freshwater species, rainbow trout, carp, eel, and a marine one, a sea bream. Oxygen content of arterial blood in the teleosts (6.7-10.7 vol. %) is much smaller than that in mammals (17.2 or 19.6 vol. %). Oxygen content of venous blood in the teleosts (1.1-2.7 vol. %) is also much smaller than that in mammals (12.9 or 13.0 vol. %). Fishes are considered to utilize the oxygen, transported to the tissues by the arterial blood, very efficiently. The percent utilization of oxygen by the tissues reached high levels (60-88 %) in contrast with the low ones (24 or 34 %) in mammals. From a different viewpoint, fishes are considered to utilize oxygen to the utmost limit, and leave little as spare. The gills of fishes are highly efficient as an oxygenator. Recovery ratio of the oxygen content of blood by the respiratory organ reached high values (2.5-8.2) in the teleosts compared with low ones (1.3 or 1.5) in mammals.

13234. Taguchi, Takeshi (Tokyo Univ. of Fisheries, Tokyo, Japan). 1970. STUDIES ON THE PROPERTIES OF FISH ACTOMYOSIN - V. ACTIVATION OF FISH ACTOMYOSIN ATPase BY LECITHIN. Bull. Jap. Soc. sci. Fish., 36(6): 612-616. (In English).

To clarify the mechanism of activation by lecithin of the actomyosin ATPase from fish muscle, the effect of lecithin on the interaction of actomyosin with ATP was examined. The marked structural change of actomyosin induced by the addition of lecithin was observed in the presence of ATP, as judged by more drop in the relative intensity of light scattering at 90°. By the treatment of actomyosin with phospholipase C, the substrate concentration curve- ATPase activity showed a sigmoidal shape. The enhancing effect of lecithin on the actomyosin ATPase activity was lost as a result of storage of the preparation and treatment with NTP, without loss of the original enzyme activity. On the other hand, although pCMB

inhibited the ATPase activity, the ATPase was susceptible to lecithin. From these results, it was assumed that the sensitive site to lecithin on the actomyosin preparation presumably is different from that to ATP.

13235. Watanabe, Takeshi, Fumio Takashima, Chinkichi Ogino, and Takashi Hibiya (Lab. of Fish. Biochem., Tokyo Univ. of Fish., Tokyo, Japan). 1970. EFFECTS OF α-TOCOPHEROL DEFICIENCY ON CARP. Bull. Jap. Soc. sci. Fish., 36(6): 623-630. (In English).

A preliminary experiment was carried out to determine the requirement of carp for vitamin E and its deficiency symptoms by using methyl esters prepared from soy-bean oil as the test oil in order to eliminate all possible vitamin E from the diet. The α-tocopherol-deficient diet induced in 90 days apparent muscular dystrophy, a characteristic symptom of the so-called "Sekoke-disease". Other deficiency symptoms included poor growth, atrophy and disarrangement of muscle fibers, and others. Ceroid deposition in the spleen, as observed in chinook salmon and land animals, was not observed in carp.

13236. Abbott, F. S., and M. B. Favreau (Dept. of Biol. Sci., Sr. George Williams Univ., Montreal, Quebec, Canada). 1971. THE EFFECT OF HYPOPHYSECTOMY ON PHYSIOLOGICAL COLOR CHANGE IN Fundulus heteroclitus. Canad. J. Zool., 49(1): 129-131.

Thirty-eight Fundulus heteroclitus were tested for ability to adapt to white and black backgrounds. They were then hypophysectomized and distributed individually to white and black containers. Their ability to adapt to background was determined for periods up to 2 weeks. Sixteen operated fish retained their preoperative ability to adapt; 8 became dark temporarily; 14 became persistently dark. Histological examination confirmed the result of the operation. In the third group of fish the persistent darkness was not associated with damage to specific areas of the brain although damage was more widespread in this group. It is concluded that hypophysectomy does not interfere with physiological color change in F. heteroclitus. The location of the central relays in the melanophore system could not be determined. (Authors)

13237. Gray, R. W., and C. W. Andrews (Dept. of Biol., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1971. AGE AND GROWTH OF THE AMERICAN EEL (Anguilla rostrata (LeSueur) IN NEWFOUNDLAND WATERS. Canad. J. Zool., 49(1): 121-128.

The age (otolith readings) and growth of American eels (Anguilla rostrata (LeSueur) from fresh and brackish waters in Newfoundland were studied. The eels in Burnt Berry Brook grew faster than eels in the other areas. The growth of young eels in brackish water was slow. Although the growth of these eels increased in subsequent age groups, freshwater eels were consistently larger at each age. The silver eel migrates after spending 12 to 13 years in Newfoundland waters. The American eel in Newfoundland is generally larger than the European eel (Anguilla anguilla L.) at the onset of migration; however, its appearance and state of maturity parallel the condition described in the European eel. (Authors)

13238. Richards, C. E., and M. Castagna (Virginia Inst. of Marine Science, Gloucester Point, Virginia). 1970. MARINE FISHES OF VIRGINIA'S EASTERN SHORE (INLET AND MARSH, SEASIDE WATERS). Chesapeake Sci., 11(4): 235-248.

A small trawl and beach seine survey was made, June 1965-July 1966, of marine fishes inhabiting 27 selected stations in seaside waters of Virginia's Eastern Shore. Seventy species were collected, 47 by trawl and 52 by seine. Eleven species are considered resident. Ten species made up 97.8% of the total number collected with Menidia menidia being the most abundant. A checklist of 96 species known to inhabit the area is given with hydrographic and distribution details for each species when known. Species assemblages by seasons for inlet, midchannel, inshore beaches, and tidal creeks are also given in tabular form. (Authors)

13239. Abdel-Magid, A. M. (Dept. of Zool., Univ. of Bristol, England). 1971. THE ABILITY OF Clarias lazera (Pisces) TO SURVIVE WITHOUT AIR BREATHING. J. Zool., Lond., 163(1): 63-72.

The respiratory behaviour of Clarias lazera under different conditions was investigated. In water saturated with air but with the fish allowed access to the surface the respiratory movements were seen to increase before it surfaced. Once the fish had settled at the bottom of the aquarium, however, a marked drop in the frequency occurred: The rate gradually built up, reaching a certain maximum before a revisit to the surface was made. At low oxygen concentrations but again with the fish allowed access to the surface, diminution of the oxygen content of the water to critical value 4-3 mg/l resulted in a marked increase in the frequency of surfacting. This lasted for only a short period, however, before the fish became acclimated and showed a regular pattern of surfacing at a relatively lower rate. The frequency again is influenced by the activity of the fish. These results conflict with Moussa's (1957) findings and show that Clarias does not die if prevented from surfacing provided that the oxygen concentration in the surrounding water is sifficiently high. This condition, however, imposes on the fish a respiratory frequency higher than normal. It was concluded that surfacing in Clarias is rhythmic. It is affected in the first place by the activity of the fish and secondly influenced by the oxygen concentration in water. The fish surfaces to inhale air which comes in contact with the accessory respiratory organs where gaseous exchange takes place. (Auth.)

13240. Holeton, George F. (Dept. of Zool., Univ. of Bristol, England). 1971. OXYGEN UPTAKE AND TRANSPORT BY THE RAINBOW TROUT DURING EXPOSURE TO CARBON MONOXIDE. J. Exp. Biol., 54(1): 239-254.

Rainbow trout, brown trout and pike were exposed to 5% carbon monoxide which was sufficient to combine with over 90% of their haemoglobin. Trout tested at 10 and 15°C did not survive exposures to carbon monoxide longer than 30 min, but those tested at 5°C survived exposures of up to 3 h. Even at 5°C the trout were weakened and unable to stay upright. The respiratory responses of trout exposed to 5% carbon monoxide at 5°C for 30 min were examined in detail. The trout responded to carbon monoxide with an increase in the flow of blood and water past the gills. As a result the mean partial pressure gradient of oxygen from water to blood across the gill membrane was increased. In spite of these changes oxygen uptake fell by 40%. An increase was observed in heart rate and blood pressure in both the ventral and dorsal aorta of CO-exposed fish. There was a drop in the oxygen diffusing capacity or transfer factor of the gills of CO-exposed trout. Although the fish were rendered anoxic there was no bradycardia, suggesting that this reflex response depends upon either environmental or arterial P_{O_2} and not upon arterial oxygen content. The observed responses to carbon monoxide may be a result of either anoxia, anoxaemia, reduced pH, or a combination of these factors. (Auth. summ.)

13241. Davis, John C., and James N. Cameron (Dept. of Zool., Univ. of Brit. Columbia, Vancouver 8, Brit. Columbia, Canada). 1971. WATER FLOW AND GAS EXCHANGE AT THE GILLS OF RAINBOW TROUT, Salmo gairdneri. J. Exp. Biol., 54(1): 1-18.

Ventilation volume was measured directly in rainbow trout using a rubber membrane attached to the mouth which separated inspired and expired water and allowed collection of the latter. Mean ventilation volume at 8.6°C for 18 trout weighing approximately 200 g was 37 $\pm$ 1.8 ml/min/fish. Mean ventilation rate and ventilatory stroke volume averaged 74 breaths/min and 0.5 ml/breath respectively. Ventilation volume could be increased nearly sevenfold during moderate, short-term hypoxia as a result of a large increase in ventilatory stroke volume and a small increase in ventilation rate. The ratio between the flow rates of water and blood through the gills was approximately 10. Percentage utilization of oxygen from inspired water had a mean of 46 $\pm$ 1.5% and ranged from 23 to 64%. Artificial perfusion of the gills with water at different flow rates was achieved by tying a tube into the mouth of trout. Perfused fish could not saturate their arterial blood with oxygen at a perfusion rate of 45 ml/min but could do so at rates ranging

from 85 to 1200 ml/min. Low arterial tensions at a perfusion rate approximating the mean V_o of fish with oral membranes are probably the result of a poor pattern of water flow over the gills during perfusion. Opercular movements occurred only at perfusion rates below 700 ml/min and increased in frequency as perfusion rate dropped. This ventilatory activity may have resulted from receptors sensitive either to water flow over the gills or to arterial P_{O_2}. As perfusion rate went up cardiac output and oxygen uptake increased. These changes were accompanied by a drop in dorsal aortic pressure which reflected vaso-dilation of the gills and peripheral circulation. This change in the pattern of blood flow through the gills contributed to a 50% increase in oxygen transfer factor across the gills. At the highest perfusion rates there was no apparent impairment of gas exchange even though anatomical deadspace was probably high. (Authors summ.)

13242. Clem, L. W. (Dept. of Microbiol., Coll. of Med., Univ. of Florida, Gainesville, Florida and Marineland Res. Labs., Marineland, Florida). 1971. PHYLOGENY OF IMMUNOGLOBULIN STRUCTURE AND FUNCTION. IV. IMMUNOGLOBULINS OF THE GIANT GROUPER, Epinephelus itaira. J. Biol. Chem., 246(1): 9-15.

Giant grouper serum was shown to contain 16 S (3 mg per ml of serum) and 6.4 S (6 mg per ml of serum) immunoglobulins. The 16 S immunoglobulin had a molecular weight of 700,000, a relatively high hexose content, and was composed of approximately equimolar amounts of H and L polypeptide chains. It is suggested that this molecule resembles immunoglobulin M on the basis of polypeptide chain properties but that it is most likely a tetramer instead of the "typical" 19 S pentamer of immunoglobulin M. The 6.4 S immunoglobulin appeared structurally to represent a fragment of the 16 S molecule; the major difference being that the 6.4 S H chain was missing 30,000 daltons. In attempting to fit the class Osteichthyes into a scheme of vertebrate immunoglobulin evolution, it was suggested that the "primitive" form of polymeric immunoglobulin M may be a tetramer of subunits held together by both disulfide and noncovalent bonds. (Auth. summ.)

13243. Ling, Victor, Bengt Jergil, and Gordon H. Dixon (Dept. of Biochem., Univ. of Brit. Columbia, Vancouver, Brit. Columbia, Canada). 1971. THE BIOSYNTHESIS OF PROTAMINE IN TROUT TESTIS. III. CHARACTERIZATION OF PROTAMINE COMPONENTS AND THEIR SYNTHESIS DURING TESTIS DEVELOPMENT. J. Biol. Chem., 246(4): 1108-1176.

Protamine isolated from rainbow trout testis can be separated into three main components, C_I, C_{II}, and C_{III}, by chromatography on microgranular carboxymethyl cellulose columns. After further purification by rechromatography on the same column, each component was analyzed for amino acid content. These analyses indicated that the components were distinct but closely related. However, each component still appeared heterogeneous since the number of residues of different amino acids assumed nonintegral values. The relative amounts of the protamine components present in spermatid nuclei were different at different stages of spermatogenesis. It appeared that the relative amount of C_I decreased while C_{III} increased during testis maturation probably as the result of differing rates of synthesis of each component. The probable function of protamine is in the packaging of DNA into the sperm head. The independent synthesis of protamine components suggests that, in spite of their similarities, they may have different specific functions. (Authors summ.)

13244. Baker, Claude D., Duncan W. Martin, and Eugene H. Schmitz (Dept. of Zool., Univ. of Arkansas, Fayetteville, Arkansas). 1971. SEPARATION OF TAXONOMICALLY IDENTIFIABLE ORGANISMS AND DETRITUS TAKEN FROM SHAD FOREGUT CONTENTS USING DENSITY-GRADIENT CENTRIFUGATION. Trans. Amer. Fish. Soc., 100(1): 138-139.

13245. Freeman, Robert A. (Dept. of Fish. and Wildl. Biol., Colo. State Univ., Fort Collins, Colorado). 1971. A CONSTANT FLOW DELIVERY DEVICE FOR CHRONIC BIOASSAY. Trans. Amer. Fish. Soc., 100(1): 135-136.

13246. Winter, Donald R. (Bur. of Standards and Surveys, Madison, Wisconsin). 1971. WATER QUALITY AND TROPHIC CONDITION OF LAKE SUPERIOR (WISCONSIN WATERS). Dept. of Natural Resources, Madison, Wis., Research Report No. 68, 26 p., illus.

Contents: Introduction; Design and Methods; Physical and chemical conditions, (Dissolved oxygen - Nutrients - Transparency - Bottom sediments); Biotic conditions, (Benthos - Seston - Cladophora - Fish net slimes); Potential pollution sources, (Superior Fiber Products, Inc. - E. I. DuPont de Nemours and Company - American Can Company - Reserve Mining Company); Conclusions; Appendix; References.

13247. Peters, Hans M. 1971. TESTIS WEIGHTS IN Tilapia (PISCES: CICHLIDAE). Copeia, No. 1, pp. 13-17.

Testis weight before and after spawning was measured in six species of Tilapia. Weights of the ripe testes in relation to body weight are small, lying within the range of testis weights of other fishes at the end of the spawning season or when sexually inactive. Loss of weight brought about by spawning is so small that it could not be detected with the methods used. These features seem to be associated with the breeding biology of Tilapia, which all exhibit forms of parental care. (Auth.)

13248. Kuehne, Robert A., and James W. Small, Jr. 1971. Etheostoma barbouri, A NEW DARTER (PERCIDAE, ETHEOSTOMATINI) FROM THE GREEN RIVER WITH NOTES ON THE SUBGENUS Catonotus. Copeia, No. 1, pp. 18-26.

Etheostoma (Catonotus) barbouri is described from 97 specimens collected from the Green River basin in Kentucky and Tennessee. It is most closely related to E. virgatum and E. obeyense which occur in the adjacent Cumberland River basin, but differs in size and body patterning. It also differs from many populations of the above species in the number of pores in the infraorbital and lateral line canals. The subgenus Catonotus is characterized and the range of E. barbouri mapped. (Authors)

13249. Howell, W. Mike, and James D. Williams. 1971. Notropis gibbsi, A NEW CYPRINID FISH FROM THE TALLAPOOSA RIVER SYSTEM IN ALABAMA AND GEORGIA. Copeia, No. 1, pp. 55-64.

Notropis gibbsi, a new cyprinid fish, is described from the Tallapoosa River system in Alabama and Georgia. It is known only from the drainage area above the Fall Line. It is compared to its nearest known relative, Notropis trichroistius (Jordan and Gilbert), from which it is geographically isolated. N. trichroistius is known from the Coosa, Cahaba, Alabama, and Black Warrior River systems. The species differ strikingly in details of tuberculation of nuptial males, snout shape, and morphology of the pre-orbital bone. N. gibbsi is further distinctive as it is the only member of the subgenus Cyprinella with head tubercles best developed on the ventral surface. (Authors)

13250. Dawson, C. E. 1971. OCCURRENCE AND DESCRIPTION OF PREJUVENILE AND EARLY JUVENILE GULF OF MEXICO COBIA, Rachycentron canadum. Copeia, No. 1, pp. 65-71.

General morphology and coloration of young cobia, 12.6-55.0 mm SL, are described and illustrated. Prejuveniles were taken in offshore Gulf of Mexico surface nekton collections during June and July. Smallest fish were found 30-40 miles offshore, whereas larger specimens, 45-140 mm SL, have been most frequently taken in inshore localities. June collections of prejuveniles suggest late April or May spawning in northern Gulf waters. (Auth.)

13251. Jacobi, G. Zolton (Dept. of Nat. Res., Wisconsin State Univ., Stevens Point, Wisconsin). 1971. A QUANTITATIVE ARTIFICIAL SUBSTRATE SAMPLER FOR BENTHIC MACROINVERTEBRATES. Trans. Amer. Fish. Soc., 100(1): 136-138.

13252. Richards, William J., and G. Robert Dove. 1971. INTERNAL DEVELOPMENT OF YOUNG TUNAS OF THE GENERA Katsuwonus, Euthynnus, Auxis, AND Thunnus (PISCES, SCOMBRIDAE). Copeia, No. 1, pp. 72-78.

Young of eight species representing four genera of Atlantic scombrids were studied using sectioned organs and tissues. Some interspecific differences were found in the nucleation of the central nervous system, development of the swimbladder, size of the postcardinal vein, meninx pigmentation, and length of the kidney and liver. Differences, however, were at the generic level and little difference was found between the closely related species. (Authors)

13253. Andrews, Austin K. (Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, Colorado). 1971. ALTITUDINAL RANGE EXTENSION FOR THE FATHEAD MINNOW (Pimephales promelas). Copeia, No. 1, p. 169.

A viable population of fathead minnows (Pimephales promelas Rafinesque) was found on 22 September 1969 in Trap Lake, Colorado, at 3034 m elevation. Previously, the highest elevation yielding P. promelas was 2898 m.

13254. Braem, Robert A., and Everett L. King, Jr. (U. S. Fish & Wildl. Serv., Marquette Biol. Station, Marquette, Michigan). 1971. ALBINISM IN LAMPREYS IN THE UPPER GREAT LAKES. Copeia, No. 1, pp. 176-179.

In the Petromyzonidae, only four albino lampreys have been reported. Sea lamprey research and control during the past two decades has required the collection and examination of many lampreys of the five species found in the upper Great Lakes. About two million lampreys in all life history stages have been examined from tributaries of Lakes Huron, Michigan, and Superior. Twenty additional albino lampreys, all from the upper Great Lakes, may now be reported. Seven albino larvae were in collections of more than 110,000 Ichthyomyzon spp.; four were from Lake Superior, two from Lake Huron, and one from Lake Michigan. Since the chestnut lamprey, I. castaneus Girard, does not range into Lake Superior or its tributaries, the four albino specimens taken there were either silver lampreys, I. unicuspis Hubbs and Trautman, or northern brook lampreys, I. fossor Reighard and Cummins. Three albino larvae collected from lakes Huron and Michigan were either chestnut, silver, or northern brook lampreys. Of more than 118,000 American brook lampreys, Lampetra lamottei (Lesueur), 11 were albinos: 10 larvae (5 from Lake Superior, 4 from Lake Michigan, and 1 from Lake Huron) and 1 adult (from Lake Michigan). One albino larval sea lamprey was captured in the Rifle River, a tributary of Lake Huron. (From authors)

13255. Lanzing, W. J. R. (School of Biol. Sci., Univ. of Sydney, Sydney, Australia). 1971. EFFECTS OF SOME ANAESTHETICS ON LABORATORY REARED Tilapia mossambica (CICHLIDAE). Copeia, No. 1, pp. 182-185.

On culturing Tilapia a number of anaesthetics were tested regarding their economy, convenience of application, reaction time, and reliability. Tilapia may take 6 min to reach full or state IV anaesthesia at a MS 222 concentration of 0.2 g/l. Propoxate is apparently the most potent anaesthetic since a concentration as low as 0.001 g/l is capable of inducing loss of equilibrium in 22 min. Urethane and chloralhydrate have the lowest potency of the drugs tested. Urethane induces sluggishness when the fish are exposed to concentrations of 0.5-5.0 g/l for 30 min. Chloralhydrate induces convulsions at 20.0 g/l and full anaesthesia is obtained after 20 min in a 21.0 g/l solution. These two drugs seem to be useful only in concentrations that approximate osmotically hypertonic media. Quinaldine induces anaesthesia almost instantaneously at concentrations of 2.0 g/l or higher. The choice of a particular anaesthetic depends mostly on research requirements. If short induction periods are essential, the choice may be MS 222 or quinaldine. For high potency or long recovery periods propoxate will be useful. Propylene phenoxetol is in some respects similar to chlorbutol. Chlorbutol is probably the most economical drug. It is a fairly common chemical (which means no problem in supply); also it is a stable product and less harmful to the fish than some of the other drugs tested. (From auth.)

13256. Ritchie, Douglas E., Jr. (Chesapeake Biol. Lab., Natural Resources Inst., Univ. of Maryland, Solomons, Maryland). 1970. EVALUATION OF GONADAL BIOPSY TECHNIQUE IN STRIPED BASS BASED ON TAGGED FISH RETURNS. Contribution No. 430, Nat. Res. Inst., Univ. of Maryland; Chesapeake Sci., 11(4): 210-215.

Returns from 2503 tagged striped bass released into the Chesapeake Bay during 1964 and 1965 were analyzed statistically and qualitatively to evaluate the effects of a gonadal biopsy technique designed for use on living fish. The results prove that the added gonadal biopsy technique does not significantly alter the survival rate of tagged striped bass. Five hundred twelve returns from 1250 tagged and biopsied (TB) fish and 445 returns from 1253 tagged only (TO) fish were grouped into 22 samples to enable the chi-square 2 x 2 contingency test of association to be calculated by both the standard and Yates corrected methods. Twenty-one of 22 samples yielded chi-square values whose probabilities (p) were non-significant, i. e., $0.50 < p < 0.75$ and $0.75 < p_c < 0.90$. One had a p-value of 0.05, denoting lack of similarity between the TB fish and the TO fish. Further, those chi-values were utilized to test the standardized normal deviate (γ) to determine if they were normally distributed. The values were $\gamma = 0.92$, $p = 0.64$ and $\gamma_c = 1.14$, $p_c = 0.74$. Thus, the survival rate as indicated by the recapture rates of TO fish was not significantly greater than TB fish. Qualitative comparisons of the reported recapture data for both categories indicate similarities with regard to frequency distribution of days of freedom, maximum days of freedom, and mean days of freedom. (Auth.)

13257. Roessler, Martin (Univ. of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Miami, Florida). 1970. CHECKLIST OF FISHES IN BUTTONWOOD CANAL, EVERGLADES NATIONAL PARK, FLORIDA, AND OBSERVATIONS ON THE SEASONAL OCCURRENCE AND LIFE HISTORIES OF SELECTED SPECIES. Bull. Marine Science, 20(4): 860-893.

One hundred and three species of fishes, representing 83 genera and 49 families, were collected in Buttonwood Canal, Everglades National Park, Florida, between January 1963 and June 1965. The following information is given for most species: (1) the seasonal occurrence of the fishes; (2) the relative abundance of the fishes in samples taken at ebb and flood tides; (3) the ranges for salinity and temperature of the water at the times the fishes were collected. For six species (Elops saurus, Harengula pensacolae, Anchoa hepsetus, Diapterus plumieri, Bairdiella chrysura, and Sciaenops ocellata) length-frequency data are presented. For eight species Brevoortia smithi, Harengula pensacolae, Opisthonema oglinum, Anchoa hepsetus, Eucinostomus gula, Lagodon rhomboides, Bairdiella chrysura, and Achirus lineatus) the catches are associated with environmental variables. For these, the catches on consecutive nights were found to be consistent, except for Harengula pensacolae, which was caught in greater numbers on the first night of fishing. No significant differences in catches could be detected between the phases of the moon, except in the period of highest relative abundance. Brevoortia and Bairdiella were most frequently caught in the spring and fall. Lagodon was most common in winter and spring. Harengula, Opisthonema, Anchoa, and Eucinostomus were most abundant in summer. Achirus appeared to exhibit no seasonal changes in catches. Season and rainfall were the most significant parameters related to the catches of these fishes. (Auth.)

13258. Nakamura, M., K. Yamada, and M. Yokote (Nagoya Univ., School of Medicine, Nagoya, Japan). 1971. ULTRASTRUCTURAL ASPECTS OF THE PANCREATIC ISLETS IN CARPS OF SPONTANEOUS DIABETES MELLITUS. Experientia, 27(1): 75-76.

Specific types of glandular cells could be differentiated electronmicroscopically in the Islets of Langerhans in the pancreas of normal and diabetic fish, namely A-, B- and D- cells as well as clear cells. In diabetic fish, the very strong multiplication of so-called clear cells above all is typical. (Authors summ.)

13259. Williams, F. (Inst. of Mar. Resources, Scripps Inst. of Oceanog., Univ. of Calif., La Jolla, California). 1970. THE SPORT FISHERY FOR SAILFISH AT MALINDI, KENYA, 1958-1968, WITH SOME BIOLOGICAL NOTES. Bull. of Marine Science, 20(4): 830-852.

Statistical data are presented on the sport fishery for sailfish, Istiophorus platypterus, at Malindi, Kenya, for the ten seasons, July 1958-June 1968. Effort has remained relatively stable, whilst catch and catch per unit effort have increased rapidly since the 1963-64 season. Catch and size of fish appear mainly independent of events taking place in the sport fishery. Aspects of length-weight relationships, length distributions, and growth are discussed with reference to Atlantic and West Pacific fish. Mean weight of sailfish in the sport and commercial fisheries is shown to have declined significantly in recent years, almost certainly due to increased fishing pressure exerted on stocks by commercial longliners in the equatorial western Indian Ocean. Migration of sailfish into East African coastal waters is discussed in relation to the environmental conditions. Recommendations are made for continued monitoring of the sport fishery and for future research. (Auth.)

13260. FAO of the UN (Food and Agriculture Organization, Rome, Italy). 1970. FAO AQUACULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF AQUACULTURE RESEARCH AND DEVELOPMENT. FAO Aquacult. Bull., 3(1): 24 p., illus.

Contents include: From research institutions ... Induced breeding - Artificial propagation of mahseer - Propagation of shrimps and prawns - Food for shrimps and prawns - Culture of fish food organisms - Feeding and food utilization - Nutrition of cutthroat trout - Liver tumour and food metabolism - Eel culture - Cage culture of tilapia - Sand smelt culture - Effects of salinity on catfish - Polyculture in brackish water - Oyster culture - Mechanical aeration - Use of tranquilizers - Control of predatory fishes - Weed control - Off-flavour in pond-cultured catfish - Lipids in cultured channel catfish. Aquaculture development ... Cameroon - Canada - Ceylon - Honduras - Japan - Kenya - Korea, Rep. of - Madagascar - Thailand - United States. Fish diseases and their control ... "Cauliflower" disease in eels - Oral immunization of coho salmon - Mercury in fish organs - Toxic effect of Anabaena bloom - Canadian Committee on Fish Diseases - Viral etiology of epizootics in carp farms and treatment of infectious dropsy. Introductions of fish ... Recent introductions - Committee on Plant and Animal Introduction - Chinese carps in Iran - Introduction of grass carp in Cuba - Introduction of Asian salmon in Canada - Piranha in South Africa. (From contents)

13261. Smith, R. J. F. (Dept. of Biol., Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada). 1970. CONTROL OF PRESPAWNING BEHAVIOR OF SUNFISH (Lepomis gibbosus AND Lepomis megalotis). II. ENVIRONMENTAL FACTORS. Animal Behavior, 18(3): 575-587.

Male longear (Lepomis megalotis) and pumpkinseed (L. gibbosus) sunfish showed high levels of aggression when kept in 25°C water under both long and short photoperiod. Lower water temperatures (11° to 13°C) inhibited both aggression and nesting. Long photoperiod (16 hr light: 8 hr dark) induced nesting by both species in 25°C water but only by longears in 11° to 13°C water. Short photoperiod (8 hr light: 16 hr dark) inhibited nesting in both species. Injection of human chorionic gonadotrophin induced nest digging in both species under short photoperiod in 25°C water but not in 11° to 13°C water. HCG had no obvious effect on aggression. Both species dug nests more readily in visual isolation than when in visual contact with con-specifics. Androgen secretion, as assayed by nest digging, is controlled by photoperiod. The level of aggression depends on water temperature and does not seem to be influenced by gonadotrophins or androgens. (Auth. summ.)

13262. Martin, James R., and Robert L. Shipp (Dept. of Biol. Sci., Florida State Univ., Tallahassee, Florida). 1971. OCCURRENCE OF JUVENILE SNOOK, Centropomus undecimalis, IN NORTH CAROLINA WATERS. Trans. Amer. Fish. Soc., 100(1): 131-132.

13263. Eberhardt, L. L., R. L. Meeks, and T. J. Peterle (Dept. of Ecosystems, Battelle Mem. Inst., Pac. Northwest Lab., Richland, Washington). 1971. FOOD CHAIN MODEL FOR DDT KINETICS IN A FRESHWATER MARSH. Nature, 230(5288): 60-62.

Data were obtained using DDT labelled with chlorine-36 on the phenyl ring. This DDT was applied in an inert granular carrier from a helicopter to an enclosed 4 acre marsh at the southwestern edge of Lake Erie in July 1964, at a rate of 0.2 pounds of technical grade DDT/acre (220 g/ha). Our model assumes an exponentially decreasing rate of release of DDT from the granules into an average of about 12 inch (30 cm) of water, followed by transfer to suspended materials (chiefly phytoplankton) and various items of the biota according to equations of the form

$$\frac{dy_2(t)}{dt} = c_2 y_1(t) - \mu_2 y_2(t) \qquad (y_i(0) = 0)$$

where $y_2(t)$ represents DDT concentration in a given "compartment", c_2 is a "transfer coefficient", μ_2 is a rate of loss and $y_1(t)$ is the concentration of the source of DDT taken in by the given compartment. The concentration of DDT in filtered water is assumed to follow the equation

$$\frac{dy}{dt} = \lambda e^{-kt} - \mu y$$

where λe^{-kt} represents release from granules, and μy losses from water due to all causes. Rate constants for this equation were obtained by a nonlinear least-squares fit to its solution. Rate constants for twenty different species were obtained five of which seemed to fit realistically into the food chains.

13264. Yacovino, Joseph T. (Okla. Fish. Res. Lab., Norman, Oklahoma). 1970. DISTRIBUTION AND ABUNDANCE OF THE ZOOPLANKTON OF CANTON RESERVOIR, OKLAHOMA. Proc. Okla. Acad. Sci., 50: 87-90.

The plankton of Canton Reservoir was sampled during 1967 and 1968. Spring pulses were noted both years. Plankton volumes also varied with horizontal location and depth. Entomostracans represented in the samples were cyclopoid copepoda, Diaptomus, Daphnia, Bosmina, Diaphanosoma, and Ceriodaphnia. Of these, only Daphnia and Diaptomus showed any vertical layering; the others occurred in about the same abundance at all depths. Daphnia and Diaptomus were the dominant springtime zooplankters, while Bosmina was dominant in summer and fall. (Auth.)

13265. Katayama, Teruhisa, Kenji Hirata, Henry Yokoyama, and C. O. Chichester (Fac. of Fish., Univ. of Kagoshima, Kagoshima, Japan). 1970. THE BIOSYNTHESIS OF ASTAXANTHIN - III. THE CAROTENOIDS IN SEA BREAMS. Bull. Jap. Soc. sci. Fish., 36(7): 709-714. (In English).

The existence of ε-carotene, 3,3'-dihydroxy-ε-carotene, lutein, α-doradecin and astacin was confirmed in the carotenoids of sea breams and these exist in the form of esters except ε-carotene. It was assumed that the bright red color of natural sea breams would come from the mixture of astaxanthin ester (red color) and α-doradexanthin ester (golden color). (Authors summ.)

13266. Ogino, Chinkichi, Takeshi Watanabe, Jun Kakino, Noriyuki Iwanaga, and Masanori Mizuno (Lab. of Fish. Biochem., Tokyo Univ. of Fish., Tokyo, Japan). 1970. B VITAMIN REQUIREMENTS OF CARP - III. REQUIREMENT FOR BIOTIN. Bull. Jap. Soc. sci. Fish., 36(7): 734-740. (In English).

Young carp were reared with diets containing graded amounts of biotin. The fish fed a biotin-deficient diet showed poor growth and a diminution of biotin content in the hepatopancreas. Nutritional requirement of young carp for biotin was 0.1 mg per 100 g of diet or 0.02-0.03 mg per kg of weight per day. The changes in histological and hematological analyses were also recognized in the biotin-deficient fish. (Authors summ.)

13267. Caillouet, Charles W., Jr. (Rosenstiel School of Mar. and Atmospheric Sciences, Univ. of Miami, Miami, Florida). 1971. LACTATE ACIDOSIS AS A CAUSE OF MORTALITY IN CAPTURED SHARKS: AN HYPOTHESIS. Trans. Amer. Fish. Soc., 100(1): p. 139.

13268. Nakamura, Takashi, and Masamichi Toyomizu (Lab. Fish. Tec., Fac. Agr., Kyushu Univ., Fukuoka, Japan). 1970. STUDIES ON FATTY ACID AMIDE IN FISHES. Bull. Jap. Soc. sci. Fish., 36(6): 631-637. (In Japanese, figures and tables in English).

The fatty acid amide compounds in organisms are known to occur in several forms - ceramide and shingolipid, N-acyl amino acid, peptidolipid, N-acyl ethanolamine, and the like. While investigating the composition of visceral lipid of fin whale Balaenoptera physalus, the authors detected another fatty acid amide compound, fatty acid amide ($RCONH_2$), which had not been found to occur in organisms. The present report is concerned with the separation, identification and distribution of $RCONH_2$ in fishes. The fatty acid amide fractions were prepared from red sea bream Chrysophyrys major and carp Cyprinus carpio by the method shown. Although the main component of the fractions was ceramide, the minor component $RCONH_2$ could be separated and identified by gas chromatography and then the composition of $RCONH_2$ was compared with that of fatty acid of crude lipid. $RCONH_2$ in red sea bream: The amounts of $RCONH_2$ found in the viscera were 82 μg% on the wet weight basis and in muscle 7 μg%. Both tissues contained $C_{14;0}$, $C_{16;0}$, $C_{17;0}$, $C_{18\ 0}$ and $C_{18\ 1}$ of $RCONH_2$. In viscera, 53.2% of the total $RCONH_2$ was C16 0, but in muscle, $C_{16:0}$, $C_{18\ 0}$ and $C_{18:1}$ were almost evenly distributed. $RCONH_2$ in carp: The amounts of $RCONH_2$ found in viscera were 172 μg% and the composition is shown. The main component of $RCONH_2$ was $C_{22:0}$, which was not detected in red sea bream. In addition, short chain $RCONH_2$ was also detected. On the other hand, only trace amounts of $RCONH_2$ were found in the muscle.

13269. Wakabayashi, Hisatsugu, Keiko Kira, and Syuzo Egusa (Dept. of Fish., Fac. of Agr., Univ. of Tokyo, Tokyo, Japan). 1970. STUDIES ON COLUMNARIS DISEASE OF POND-CULTURED EELS - II. THE RELATION BETWEEN GILL DISEASE AND Chondrococcus columnaris. Bull. Jap. Soc. sci. Fish., 36(7): 678-685. (In Japanese, figures and tables in English).

In a previous study it was clarified by experiments that in eels Chondrococcus columnaris infection results in a partial loss of the gill filaments, which is known as a symptom peculiar to the so-called gill disease of pond-cultured eels. In the present study the causative relationship between the gill disease and the bacterium was investigated with eels in actual eel-ponds at Yoshida, Shizuoka Prefecture. Comparisons made during a gill-disease-prevalent season, between moribund and apparently healthy eels, revealed that although healthy eels too commonly had affected gill filaments, often harbouring C. columnaris on the gills and sometimes agglutinins to the bacterium, moribund eels generally had more seriously damaged gills and more frequently had the agglutinins, while there was no definite difference between the two in the rate of which the organism was isolated from the gills. A bimonthly investigation of healthy eels revealed that (1) partial loss of gill filaments was observed throughout the year and the average degree of loss of gill filaments was larger in the warm months and minimum in February; (2) C. columnaris was isolated from the gills in a part of the fishes examined in June, August and October, but not in December to April; and (3) the percentage of fishes having the agglutinins was higher in April and June and low in August to February, being minimum in February. No other germs nor parasites which were considered to be responsible for the gill disease were detected. From these results it is suggested that (1) the activity of C. columnaris in eel-ponds starts about in April, reaches its height in summer and comes to an end in October; (2) the process of development of gill lesions may be different according to the virulence of the bacteria and environmental factors, including competitive bacteria. In some cases the bacteria cause serious damage to the gills leading to speedy death, while in others the bacteria once grown on the gills disappear, leaving a partial loss of gill filaments in the affected areas. The possibility that slight injuries caused by food particles passing over the gills may enable C. columnaris to obtain a foothold on the gills is also suggested.

13270. Katayama, Teruhisa, Henry Yokoyama, and C. O. Chichester (Fac. of Fish., Univ. of Kagoshima, Kagoshima, Japan). 1970. THE BIOSYNTHESIS OF ASTAXANTHIN - II. THE CAROTENOIDS IN Benibuna, Carassius auratus, ESPECIALLY THE EXISTENCE OF NEW KETO CAROTENOIDS, α-DORADECIN AND α-DORADEXANTHIN. Bull. Jap. Soc. sci. Fish., 36(7): 702-708. (In English).

The presence of β-carotene, zeaxanthin, lutein, α-doradecin and astacin was confirmed in Benibuna and all of those carotenoids except β-carotene exist in the form of esters. A possible biosynthetic pathway from lutein ester to astaxanthin ester is proposed in Benibuna and it is identical with that of goldfish.

13271. Yoshida, Yoichi, and Hiroshi Sera (Dept. Fish., Fac. Agr., Kyoto Univ., Maizuru, Japan). 1970. ON CHITINOLYTIC ACTIVITIES IN THE DIGESTIVE TRACTS OF SEVERAL SPECIES OF FISHES AND THE MASTICATION AND DIGESTION OF FOODS BY THEM. Bull. Jap. Soc. sci. Fish., 36(8): 751-754. (In Japanese, table in English).

In fish which feed on organisms with chitinous shells, such as shrimps and most zooplanktons, the chitinolytic activities in the stomach were found to be high in the cardiac part and in the blind sac of the stomach, but comparatively low in the pyloric part. The chitinolytic activity in the stomach of Konosirus punctatus, or Mugil cephalus, which feeds mainly on phytoplankton in sea water or detritus and microbenthos on bottom muds were low or negligible. In Pagrus major and Trachurus japonicus, the mastication and digestion of Metapenaeus joyneri and its course in the digestive tract was examined. The mastication and digestion of the foods in digestive tracts of these fishes are further discussed.

13272. Sakaguchi, Morihiko, and Akira Kawai (Res. Inst. for Food Sci., Kyoto Univ., Kyoto, Japan). 1970. HISTIDINE METABOLISM IN FISH - V. THE EFFECT OF PROTEIN-DEFICIENCY UROCANASE IN CARP LIVER. Bull. Jap. Soc. sci. Fish., 36(8): 783-787. (In English).

Distribution of histidine deaminase and urocanase in various tissues of carp was examined. High histidine deaminase activity was found in the liver, and low activity in the kidney and spleen but not in the heart and muscle. Urocanase activity in the liver tissue was higher than that in the kidney. Carp fed on 5% casein diet for 2 weeks gave the low levels of liver histidine deaminase and urocanase, compared with the fish on 80% casein diet. Supplementation of 2.7% of histidine to the low protein diet caused appreciable elevation of both the enzyme levels. Liver histidine deaminase and urocanase of carp fasting for 2 weeks showed higher activities per unit weight than those of the fish on the high protein diet but there were no differences in the activities of whole liver tissue between these fish.

13273. Hashimoto, Yoshiro, Shigeru Arai, and Takeshi Nose (Lab. of Mar. Biochem., Fac. Agr., Univ. of Tokyo, Tokyo, Japan). 1970. THIAMINE DEFICIENCY SYMPTOMS EXPERIMENTALLY INDUCED IN THE EEL. Bull. Jap. Soc. sci. Fish., 36(8): 791-797. (In English).

The eel developed typical deficiency symptoms on two types of thiamine-deficient diet. Besides the disappearance of appetite followed by retardation of growth, ataxia characterized by abnormality in swimming appeared. At the advanced stage, the body trunk became stiff and revealed severe bending. Such a thiamine deficiency symptom has not yet been reported on the other species of fish and may be attributable to the long and flexible body of the eel. The hemorrhage was remarkable especially in the vertical fin. This symptom has been reported to occur in carp. In the eel receiving a thiamine-deficient clam diet, thiamine decreased quite slowly and the mortality was low even when their growth stopped completely. This may suggest that the eel can tolerate the deficiency of thiamine for a considerably long time. The carp, eel and catfish (Parasilurus asotus) are all known to possess thiaminase. The metabolism of thiamine in the fish lacking thiaminase seems to differ markedly from that of fish possessing the enzyme. Further examination is necessary to reveal the connection between thiamine requirement and presence of thiaminase in fish. It was found that the Halver diet devised for salmonoid fish could support only extremely poor growth of eel when compared to beef liver or Tubifex. A synthetic diet fulfilling the specificity of eel should be developed for the study of its nutritional requirement.

13274. Yoshida, Yoichi (Dept. Fish., Fac. Agr., Kyoto Univ., Maizuru, Japan). 1970. STUDIES ON THE EFFICIENCY OF FOOD CONVERSION TO FISH BODY GROWTH - III. TOTAL UPTAKE OF FOOD AND THE EFFICIENCY OF TOTAL FOOD CONVERSION. Bull. Jap. Soc. sci. Fish., 36(9): 914-916. (In Japanese, figures in English).

Following the formulae obtained in the previous paper, the formulae to determine the total uptake of food, the efficiency of food conversion, and the efficiency of total food conversion were introduced and an attempt to apply these to the breeding data of the amber fish Seriola quinqueradiata obtained by Harada has been made. From the results of these attempts, it is ascertained that the formulae introduced are pretty well applicable to the data.

13275. Yoshida, Yoichi (Dept. Fish., Fac. Agr., Kyoto Univ., Maizuru, Japan). 1970. STUDIES ON THE EFFICIENCY OF FOOD CONVERSION TO FISH BODY GROWTH - IV. EFFECTS OF TEMPERATURE TO THE COEFFICIENTS β', β, AND γ. Bull. Jap. Soc. sci. Fish., 36(9): 917-920. (In Japanese, figures in English).

The effects of temperature on the coefficients β', β and γ were examined, by using the results obtained in the breeding experiments of the amber fish Seriola quinqueradiata and in field studies on the cod Gadus callarias. Of the temperature quotient (Q_{10}) of the coefficients, those of β', β and γ of the amber fish (16-26°C) were 2.9, 2.9 and 3.3, respectively, and those of β and γ of the cod (4-14°C) were comparatively high, 5.3 and 8.2, respectively. The value of $W_{max}^{1/3}$ (or β/γ) was indicated inversely to decrease with the increase of temperature in both fishes. The growth curves of the amber fish were estimated by using coefficients obtained and the effects of temperature and season on the growth were examined.

13276. Itazawa, Yasuo (Dept. of Fish., Fac. Agr., Kyushu Univ., Fukuoka, Japan). 1970. HEART RATE, CARDIAC OUTPUT AND CIRCULATION TIME OF FISH. Bull. Jap. Soc. sci. Fish., 36(9): 926-931. (In English).

Heart rate (beats/min.) determined from electrocardiogram recorded in conditions as near to natural as possible was 42-51 (the mean 46) in the rainbow trout, and 20-54 (the mean 32) in the eel. Cardiac output (ml/kg, min.) estimated by Fick's principle was 16.0 in the rainbow trout, 20.7 in the carp, 18.8 in the eel, and 36.6 in Oplegnathus. Mean total circulation time (min.) estimated from the cardiac output and the blood volume was 2.2 in the rainbow trout, 1.7 in the carp, 1.9 in the eel, and 1.0 in Oplegnathus. Tissues of fish are considered to receive much smaller amount of blood in a given time compared with mammals.

13277. Yamaguchi, Katsumi, Kanehisa Hashimoto, and Fumio Matsuura (Lab. of Mar. Biochem., Fac. Agr., The Univ. of Tokyo, Tokyo, Japan). 1970. STUDIES ON A BLUE-GREEN SERUM PIGMENT OF EEL - V. LIPID MOIETY. Bull. Jap. Soc. sci. Fish., 36(9): 955-962. (In English).

Lipid of biliverdin-lipoprotein in eel serum was fractionated into four fractions: Acetone-soluble, ether-soluble conjugated, ether-insoluble conjugated, and firmly combined lipid fractions. The acetone-soluble lipid fraction consisted of glycerides, free fatty acids, cholesterol esters, free cholesterol, with small amounts of alcohols and the other unsaponifiable substances. The main fatty acids in this fraction were 16:0 and 18:1 acids amounting to about 1/3 each of the total. Conjugated lipid fractions were composed of phosphatidylserine and a sort of phospholipid, the nature of which reamins to be clarified. The proportions of lipid fractions in the biliverdin-lipoprotein fluctuated considerably, while the composition of each fraction was relatively fixed and characteristic. Therefore, if the biliverdin-lipoprotein takes part in lipid transport in living eel, the mechanism might be different from that of the lipoprotein in higher animals.

13278. Oguri, Mikio (Fish. Lab., Fac. Agr., Nagoya Univ., Chikusa, Nagoya, Japan). 1970. OSMOREGULATION AND ENDOCRINE GLANDS OF TELEOSTS. Bull. Jap. Soc. sci. Fish., 36(6): 638-650. (In Japanese).

13279. Watanabe, Takeshi, Fumio Takashima, Chinkichi Ogino, and Takashi Hibiya (Lab. of Fish. Biochem., Tokyo Univ. of Fish., Tokyo, Japan). 1970. REQUIREMENT OF YOUNG CARP FOR α-TOCOPHEROL. Bull. Jap. Soc. sci. Fish., 36(9): 972-976. (In English).

It was demonstrated again that when supplemented with α-tocopherol the diet containing 5% of methyl esters sustains the normal growth of carp fingerlings. This may suggest that this formula can be used efficiently for the study on requirement for fat-soluble vitamins. The previous postulation, that the apparent muscular dystrophy of carp, as observed in the so-called "Sekoke-disease" or the disease induced by oxidized oil, is coupled with α-tocopherol deficiency, was further strengthened by the present work. High moisture and low protein contents of the muscle were observed in the tocopherol-deficient group. In ultracentrifugation, it was found that a protein fraction soluble in 0.6 M KCl, chiefly consisting of myosin and actomyosin, had decreased significantly in the muscle of the deficient fish, and the details will be reported in another paper. A large number of the fish fed a diet lacking tocopherol displayed lordosis along with a high mortality rate. Lordosis is occasionally observed in carp fingerlings reared in culture ponds and was noted to some extent in all groups in the present study. It was, however, considerably pronounced in the deficient fish. This may suggest that lordosis was enhanced by the absence of tocopherol.

13280. Wright, Samuel G. (Wash. Dept. Fisheries, Olympia, Washington). 1970. AN EXAMINATION OF WASHINGTON'S TROLL SALMON FLEET IN 1967. Wash. Dept. Fish. Fish. Res. Pap., 3(2): 5-17.

Studies were made in 1967 to determine the composition and changes in the troll salmon fleet and to gain a better understanding of catch and effort statistics for the fishery. The fleet totalled 2,372 licensed vessels as follows: 948 com-sports, 690 trollers, 371 kelpers, 200 day boats, and 163 charter boats. Increased fleet size was primarily due to com-sports. From examination of landings by a random 10% sample of licensed boats, it was determined that trollers accounted for 50% of the landings and over 75% of the troll salmon poundage landed during 1967. Recommendations are made for improvement of the statistical system which presently may provide misleading measures of catch and effort. (Auth.)

13281. Phinney, Duane E., and Gene Deschamps (Wash. Dept. Fisheries, Aberdeen, Washington). 1970. THE USE OF MESH RESTRICTIONS TO MINIMIZE THE STEELHEAD CATCH IN THE GRAYS HARBOR GILLNET FISHERY FOR SALMON. Wash. Dept. Fish. Fish. Res. Pap., 3(2): 19-28.

In Grays Harbor, Washington, coho salmon, Oncorhynchus kisutch (Walbaum), and steelhead trout, Salmo gairdneri Richardson, overlap in the timing of their spawning migration. To minimize the catch of steelhead, which have been classified by law as game fish and may not be taken by commercial gear, a minimum gill-net mesh size of 7-1/2 inches has been instituted for the period of overlap in timing through the gill-net fishery. The usual mesh size of gill nets used for coho is about 6-1/2 inches. Comparison of steelhead catches in the gill-net fishery for the years before and after the 7-1/2-inch mesh restriction indicated that the large-mesh restriction reduced the steelhead catch. It was concluded that only a minimal loss to the steelhead sport fishery resulted when gill nets 7-1/2 inches or larger were employed. (Authors)

13282. Gunderson, Don (Wash. Dept. Fisheries, Seattle, Washington). 1970. A NOTE ON TECHNIQUES AND INTENSITY REQUIRED FOR PACIFIC OCEAN PERCH CATCH SAMPLING. Wash. Dept. Fish. Fish. Res. Pap., 3(2): 29-35.

Four commercial catches of Pacific Ocean perch from three different boats were sampled for length. All catches were made in the same general area over a 17-day period. Within each catch three groups of 246 to 324 fish were measured, each group originating from the first, middle or last portion of the catch unloaded. Analysis of variance indicated that no significant differences in length existed within a given catch but that there were significant, large-scale differences between catches. It was suggested that market sampling of Pacific Ocean perch be planned

so that only one sample is collected from a given boat but that most sampling effort goes into sampling a large number of catches. (Auth.)

13283. Richey, Eugene P., and Charles K. Sollitt (Dept. of Civil Engineering, Univ. of Wash., Seattle, Washington). 1970. PNEUMATIC DESTRATIFICATION OF DENSITY LAYERS. Wash. Dept. Fish. Fish. Res. Pap., 3(2): 37-52.

An analysis was made to determine the energy required to mix a stratified water body by injecting air at a given depth. The efficiency of the mixing process as dependent upon air flow rate and degree of stratification was determined from experiemental laboratory-scale data. After computing the potential energy increase needed for destratification, it is possible to compute the energy required to convert a lake from a thermally stratified to an isothermal condition. The procedure is demonstrated for a small lake. (Authors)

13284. DiDonato, Gene, and Nick Pasquale (Wash. Dept. Fisheries, Seattle, Washington). 1970. MIGRATION OF PETRALE SOLE TAGGED IN DEEP WATER OFF THE WASHINGTON COAST. Wash. Dept. Fish. Fish. Res. Pap., 3(2): 53-62.

During February 1962 petrale sole, Eopsetta jordani (Lockington), in spawning condition were captured in 175 to 230 fathoms for tagging. Releases totalled 4,461 petrale sole in the Willapa Deep and 55 in the Destruction Island Deep, and recoveries through 1969 were 4.0% and 5.5%, respectively. Recaptures exhibited a northerly, inshore movement along the Washington coast and the west coast of Vancouver Island where both sexes contributed to the summer (April-October) inshore fishery of less than 90 fathoms. A return to the deep-water spawning areas occurred during winter (November-March). Most recaptures returned to the same spawning area but a few strayed as far south as California. The Washington spawning stock appears to be separate from the Esteban Deep spawning stock to the north and from spawning stocks found off Oregon and California. Mixing of stocks does occur, but mostly during the summer months when the fish are inshore along the continental shelf. (Authors)

13285. Wright, Samuel G. (Wash. Dept. Fisheries, Olympia, Washington). 1970. SIZE, AGE, AND MATURITY OF COHO SALMON IN WASHINGTON'S OCEAN TROLL FISHERY. Wash. Dept. Fish. Fish. Res. Pap., 3(2): 63-71.

From 1950 through 1968, sampling of coho salmon, Oncorhynchus kisutch (Walbaum), was conducted annually at Washington's major troll salmon landing ports. Data collected during this period confirmed the dependence of Washington's fishery on a single age group during any given season (i.e., 3_2 coho). Annual troll catches ranged from 1.5 to 7.4 million lb. and seasonal average weights from 6.4 to 8.5 lb. Length-weight formulae were developed for conversion to numbers of fish. For management of the fishery, it was determined that a minimum size limit of approximately 16 inches total length would allow retention and subsequent marketing of virtually all 3-year-old coho and many of the maturing 2-year-old males (jacks), while affording protection to 2-year-old immature coho. (Auth.)

13286. Gomez, Ricardo (Okla. Fish. Res. Lab., Norman, Oklahoma). 1970. FOOD HABITS OF YOUNG-OF-THE-YEAR STRIPED BASS, Roccus saxatilis (Walbaum), IN CANTON RESERVOIR. Proc. Okla. Acad. Sci., No. 50: 79-83.

By the rather large variety of food items found in the stomachs, it was apparent that young-of-the-year striped bass fed opportunistically. No evidence of selectiveness for any particular species of forage was noted. It was interesting that no annelid worms were found in the stomachs and it appears that the young-of-the-year striped bass in Canton Reservoir obtained most of their food from open-water rather than bottom sources.

13287. Addison, W. D., and R. A. Ryder (Thunder Bay, Ontario, Canada). 1970. AN INDEXED BIBLIOGRAPHY OF NORTH AMERICAN Stizostedion (PISCES, PERCIDAE) SPECIES. Ontario Dept. of Lands and Forests, Research Information Paper (Fisheries) No. 38, 318 p.

13288. Cairns, John, Jr., Roger L. Kaesler, and Ruth Patrick (Biol. Dept., Virginia Polytechnic Inst., Blacksburg, Virginia). 1970. OCCURRENCE AND DISTRIBUTION OF DIATOMS AND OTHER ALGAE IN THE UPPER POTOMAC RIVER. Notul. nat. Acad. Philad., 436, 12 p.

Ten limnological surveys were made of a portion of the upper Potomac River in conjunction with installation and expansion of the Dickerson power station of the Potomac Electric Power Company. Cluster analyses of matrices of Jaccard coefficients computed from presence-absence data on 1) 344 species of diatoms in 46 aggregations and 2) 161 species of other algae in 50 aggregations yielded results in agreement with those obtained in similar studies of protozoans and insects and also with results of species diversity studies. These studies indicate that the populations of diatoms in these areas were very similar before and after plant operations started, and there was no evidence from the diversity or kinds of species of adverse effects due to power plant discharge. (Authors)

13289. Kleeman, Karl T., J. L. Fryer, and K. S. Pilcher (Dept. of Microbiol., Oregon State Univ., Corvallis, Oregon). 1970. OBSERVED DIFFERENCES IN CO_2 REQUIREMENTS BETWEEN MAMMALIAN AND SALMONID FISH CELL LINES. J. Cell Biol., Vol. 47, pp. 796-798.

Although salmonid cell cultures did demonstrate a growth requirement for CO_2, their ability to grow in bicarbonate-free Tris-buffered medium with free gas exchange with the air sets them apart from most mammalian cells. (From authors discussion).

13290. Major, Richard L., and Herbert H. Shippen (NMFS Biol. Lab., Seattle, Washington). 1970. SYNOPSIS OF BIOLOGICAL DATA ON PACIFIC OCEAN PERCH Sebastodes alutus. U. S. Dept. of Commerce, NOAA, NMFS, FAO Species Synopsis No. 79, Circular 347, 38 p., illus.

This synopsis has information on the taxonomy, life history, population structure, and harvesting of a species that is being intensively fished and studied by the United States, Canada, the U. S. S. R., and Japan. This synopsis includes data from scientific papers either printed in English or translated from Japanese and Russian into English. (Authors)

13291. Grinstead, Bobby Gene. 1969. THE VERTICAL DISTRIBUTION OF THE WHITE CRAPPIE IN THE BUNCOMBE CREEK ARM OF LAKE TEXOMA. Okla. Dept. of Wildlife Conservation Bull. No. 3, 37 p.

The depth distribution of the white crappie, Pomoxis annularis Rafinesque, was studied in the Buncombe Creek arm of Lake Texoma. White crappie were found to have similar vertical distribution patterns in the two study areas, although the mean depth of capture was somewhat deeper in open water than near the shoreline. The mean depth of capture of white crappie was deepest (25.79 feet) during the month of January and nearest the surface (16.91 feet) in April. Returns of tagged white crappie indicated that some individuals in the population move considerable distances but the majority tend to remain in a somewhat limited area. It was concluded that migrations or horizontal movements did not seriously influence the vertical distribution of this species. There were no indications from data collected in this study of water temperature affecting the distributional patterns. White crappie were not collected in water with a dissolved oxygen concentration lower than 3.3 ppm., but these concentrations were only sampled with 0.8 percent of the netting effort so the significance of this occurrence could not be determined. No other chemical factors were found which appeared to have an influence upon the depth distribution of the white crappie. White crappie did appear to be influenced by light penetration, generally they occurred at a greater depth when the turbidity was low and nearer the surface as turbidity increased. (From auth. summ.)

13292. Lewis, Steven A. (Okla. Fish. Res. Lab., Norman, Oklahoma). 1970. AGE AND GROWTH OF WALLEYE, Stizostedion vitreum vitreum (Mitchill), IN CANTON RESERVOIR, OKLAHOMA. Proc. Okla. Acad. Sci., No. 50, pp. 84-86.

Canton walleye had a higher growth rate and an earlier sexual maturity than walleye in most other states. The females, while growing faster than the males, had the same length-weight relationship. (Auth. conclusions)

13293. Hettler, William F., Jr., Richard W. Lichtenheld, and Herbert R. Gordy (Bur. of Comm. Fish., Center for Estuarine and Menhaden Research, Beaufort, North Carolina). 1971. OPEN SEAWATER SYSTEM WITH CONTROLLED TEMPERATURE AND SALINITY. Progr. Fish Cult., 33(1): 3-11.

An open system provides a filtered supply of temperature- and salinity-regulated water for rearing estuarine animals and studying their physiology and behavior. At the seawater intake, water is pumped through 10 tons of silica sand contained in two 1,000-gal concrete tanks submerged in 12 ft of water. Salinity is instrumentally controlled by proportionally mixing freshwater and seawater. Temperature is regulated to any biologically suitable level above that of the incoming seawater by means of hot water flowing through heat exchangers. (Authors)

13294. Bishop, Frank G. (Dept. of Zool., Univ. of Alberta, Edmonton, Alberta, Canada). 1971. OBSERVATIONS ON SPAWNING HABITS AND FECUNDITY OF THE ARCTIC GRAYLING. Progr. Fish Cult., 33(1): 12-19.

The main spawning activity of the Arctic grayling (Thymallus arcticus) took place from noon until dusk and apparently was governed by the water temperature. Artificially fertilized eggs hatched in 13.7 days in an average water temperature of 8.8°C. An estimate by volumetric displacement indicated an average of 310.9 eggs per ounce of female grayling. The spawning behavior of T. arcticus was very similar to that of T. thymallus. (Auth.)

13295. Banks, Joe L., Laurie G. Fowler, and Joseph W. Elliott (Bur. Sport Fish. and Wildl., Salmon-Cultural Lab., Longview, Washington). 1971. EFFECTS OF REARING TEMPERATURE ON GROWTH, BODY FORM, AND HEMATOLOGY OF FALL CHINOOK FINGERLINGS. Progr. fish Cult., 33(1): 20-26.

Fall chinook salmon (Oncorhynchus tshawytscha) fingerlings averaging 1.38, 2.10, 2.70, 5.88, and 8.94 grams were studied during 4-week periods at 50°, 55°, 60°, and 65° F. to determine the temperature most favorable for growth, and to observe the effects of temperature on body form and hematology. Of these temperatures, 60°F appeared closest to the optimum for growth for all sizes of fingerlings. No differences in the relationship between the cube of the fork length and the weight were found among fish reared at these temperatures. Regression of fork length cubed in millimeters against weight in grams did not deviate significantly from a straight line with the formula $L^3 \times 10^{-5} = 0.2700 + 0.7721W$. Fingerlings growing at different rates because of temperature apparently maintain the same relatively constant body conformation. Reasonable accuracy may also be assumed in calculating average fork length or average weight if only one of these variables is known. Increased corpuscular counts, hematocrits, and hemoglobin levels were associated with increased rearing temperatures only in fish averaging 4 grams or less. (Authors)

13296. Earnest, Russell D. (Bur. Sport Fish. and Wildl., Fish-Pesticide Res. Lab., Tiburon, California). 1971. THE EFFECT OF PARAQUAT ON FISH IN A COLORADO FARM POND. Progr. Fish Cult., 33(1): 27-31.

A single application of paraquat at 1.1 ppm controlled Chara but also resulted in a fish kill. Residue analysis of fish tissue indicated that paraquat levels in the bluegill (Lepomis macrochirus) exceeded 1 ppm 32 days after treatment. The herbicide was not detectable in water at 32 days, but was still measurable in mud after 99 days. Histopathological examination of paraquat-exposed and control fish revealed no marked difference. (Auth.)

13297. Wellborn, Thomas L., Jr. (Bur. Sport Fish. and Wildl., Auburn Univ., Auburn, Alabama). 1971. TOXICITY OF SOME COMPOUNDS TO STRIPED BASS FINGERLINGS. Progr. Fish Cult., 33(1): 32-36.

Standard bioassay methods were used to determine the toxicity of 9 therapeutic and herbicidal compounds to striped bass (Morone saxatilis) fingerlings. The compounds tested were: Acriflavine (Neutral), Aquathol, Bayluscide, Casoron, Co-Ral, Lindane, malachite green oxalate, Malathion, and Terramycin Concentrate. Malathion and Lindane, had 96-hour LC_{50}'s of 0.24 and 0.40 ppm, respectively.

Malachite green oxalate was the most toxic compound after 24 hours' exposure, showing an LC_{50} of 0.30 ppm. The 48- and 96-hour LC_{50}'s for malachite green oxalate were not obtained. Casoron was the least toxic, with a 96-hour LC_{50} of 6,200 ppm. (Auth.)

13298. Holway, Jamieson E., and G. W. Klontz (Bur. Sport Fish. and Wildl., Fish Cultural Development Center, Bozeman, Montana). 1971. A PROCEDURE FOR TESTING THE ANTIGENICITY OF VACCINES FOR IMMUNIZATION OF FISH AGAINST FURUNCULOSIS. Progr. Fish Cult., 33(1): 42-44.

Antibody production by rainbow trout (Salmo gairdneri) was confirmed at timed intervals after injection of furunculosis antigens, using the agar-gel precipitin reaction. The test is a simple, effective method of evaluating antigen production. (Authors)

13299. Hannan, Herbert H., and Bobby T. Anderson (Aquatic Sta., Southwest Texas State Univ., San Marcos, Texas). 1971. PREDICTING THE DIEL OXYGEN MINIMUM IN PONDS CONTAINING MACROPHYTES. Progr. Fish Cult., 33(1): 45-47.

The oxygen balance in 2 ponds containing macrophytes was studied on a seasonal basis. When the pH was 8.1 or less, or bicarbonate alkalinity was 95 mg/l or greater between 0600 and 0800 hours, the time of minimum dissolved oxygen, 4.0 mg/l or less dissolved oxygen, occurred for a period of time during the diel cycle. It is suggested that these values for pH and bicarbonate alkalinity, as related to the diel dissolved oxygen minimum in ponds containing macrophytes, are of predictive significance. (Authors)

13300. Blaylock, B. G., and N. A. Griffith (Radiation Ecology Section, Health Physics Div., Oak Ridge, Tennessee). 1971. A LABORATORY TECHNIQUE FOR SPAWNING CARP. Progr. Fish Cult., 33(1): 48-50.

A technique for artificially breeding carp, Cyprinus carpio, has been developed to the extent that it can be used for biological testing. The sticky layer that develops on the surface of the fish eggs, causing them to clump, was controlled with a 0.6% NaCl solution. Treated eggs were poured into hatching trays in such a manner that 96% of the eggs hatched, and individual eggs, could be counted. (Authors)

13301. Bedell, Gerald W. (Calif. Dept. of Fish and Game, Sacramento, California). 1971. ERADICATING Ceratomyxa shasta FROM INFECTED WATER BY CHLORINATION AND ULTRAVIOLET IRRADIATION. Progr. Fish Cult., 33(1): 51-54.

Although neither ultraviolet irradiation nor chlorination completely prevented occurrence of Ceratomyxa shasta among rainbow trout, test results were encouraging. Indications were that either method could completely eliminate Ceratomyxa from infected water. (Auth.)

13302. Parker, W. D. (Game and Fish Div., Alabama Dept. of Conservation, Montgomery, Alabama). 1971. PRELIMINARY STUDIES ON SEXING ADULT LARGEMOUTH BASS BY MEANS OF AN EXTERNAL CHARACTERISTIC. Progr. Fish Cult., 33(1): 55-56.

A morphological study showed that the scaleless area surrounding the urogenital openings was shaped differently in some male and female largemouth bass, Micropterus salmoides. Examination of specimens collected from different sections of Alabama during different seasons showed that for bass 14 inches and over in total length, a sexing accuracy of 92% could be attained, and for bass under 14 inches in total length, 51%. (Auth.)

13303. Sethi, Hari S. (Dept. of Zool., Calif. State College, Los Angeles, California). 1971. A FISH RESPIROMETER. Progr. Fish Cult., 33(1): 60-61.

A fish respirometer imposes precise water velocities and can be used in a small experimental tank containing flowing water at a desired temperature level. (Auth.)

13304. White, R. L., and R. L. Bounds (Texas Parks and Wildlife Dept., Waco, Texas). 1971. A PLASTIC BARRIER FOR SPOT TREATMENT OF AQUATIC VEGETATION. Progr. Fish Cult., 33(1): 57-59.

A plastic barrier was used to prevent wave-action dilution of herbicide concentrations used for spot treatments of vegetation on large lakes. Polyethylene sheeting was attached to old gill nets and braced in position by reinforcement steel rods. An aquatic herbicide, at 0.5 to 1.00 ppm, was applied to sites containing dense growths of Myriophyllum brasiliense and Najas guadalupensis. Using the barriers from 24 to 72 hours provided good control of the vegetation for 3 to 6 months after treatment. (Authors)

13305. Vogele, L. E., R. L. Boyer, and W. R. Heard (Bur. Sport Fish. and Wildl., So. Central Reservoir Investigations, Fayetteville, Arkansas). 1971. A PORTABLE UNDERWATER SUCTION DEVICE. Progr. Fish Cult., 33(1): 62-63.

An air lift was developed as an underwater suction device to collect egg and larvae contents from centrarchid nests. The device, made portable by using a scuba cylinder as the source of compressed air, was operated successfully to a depth of 35 feet. (Authors)

13306. Levesque, Raymond C. (Coop. Fish. Unit, Univ. of Mass., Amherst, Massachusetts). 1071. AN ELECTROSHOCKING TECHNIQUE FOR COLLECTION OF JUVENILE SHAD AT HYDROELECTRIC PLANT INTAKE GRATES. Progr. Fish Cult., 33(1): p. 47.

A stream electroshocker, used at hydroelectric plant intakes, effectively collected juvenile American shad (Alosa sapidissima) in a range of 1,000-1,600 per hour. Mortality was limited, and schools reformed within 5 to 10 minutes after shocking. (Auth.)

13307. Imler, Richard (Colo. Div. Game, Fish and Parks, Fort Collins, Colorado). 1971. RADIO TELEMETRY AS AN AID IN WINTER GILL NETTING. Progr. Fish Cult., 33(1): p. 59.

A standard FM transmitter-receiver system is used to locate a Prairie ice jigger under ice and snow. (Auth.)

13308. Rio, Guido J., and Rose A. Recco (Dept. Biol., St. John's Univ., Jamaica, New York). 1971. EFFECTS OF COLD STORAGE ON SERUM ANTIBODIES OF THE GOLDFISH. Progr. Fish Cult., 33(1): 37-41.

Samples of immune serum not used immediately should be aseptically stored at either room or refrigerated temperature. However, freezing goldfish (Carassius auratus) serum converted a positive serum to a negative serum. A positive reaction apparently depends upon the storage condition of the fish -- the length of time that the fish has been immunized.

13309. Theis, G. L. (Fish Cultural Development Center, Lamar, Pennsylvania). 1971. IRRIGATION PIPE FOR TRANSPORT OF FISH. Progr. Fish Cult., 33(1): p. 26.

Five-inch aluminum irrigation pipe, 230 feet long, was tested as a means of transporting 10.2-inch rainbow trout. Most of the fish went through the pipe in about 1 minute.

13310. Bumgarner, Daniel H. (Bur. Sport Fish. and Wildl., Atlanta, Georgia). 1971. A TECHNIQUE FOR CONTROLLING TROUT GROWTH. Progr. Fish Cult., 33(1): p. 41.

Tests on hatchery-reared trout showed that 30- and 60-day periods of starvation can be used as a growth-control technique. The lowest hemoglobin reading recorded was 6.0; the average, 8.0.

13311. Edwards, Gary B. (Dept. of Zool., Arizona State Univ., Tempe, Arizona). 1971. ACTUAL VERSUS REPORTED FISHING TIMES AS A FACTOR IN CREEL CENSUS DATA. Progr. Fish Cult., 33(1): p. 54.

Observation through binoculars showed that the actual fishing times of 44

individual anglers totaled 65 hours 54 minutes. When interviewed for a standard creel census, however, these anglers collectively reported 73 hours 1 minute fishing time.

13312. Post, George (Colo. State Univ., Fort Collins, Colorado). 1971. SYSTEMATIC GRADING OF GILL HYPERPLASIA. Progr. Fish Cult., 33(1): p. 61.

A standard procedure for grading gill hyperplasia is proposed.

13313. Burton, Dennis T. (Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1970. THE ANAEROBIC RESPONSES OF BROWN BULLHEAD CATFISH (Ictalurus nebulosus) DURING GRADUAL HYPOXIA AT TWO ACCLIMATION TEMPERATURES. American Zoologist, 10(4): p. 519.

Lactate is the typical anaerobic end product produced by fishes under hypoxic conditions. However, Blazka has suggested that free short-chain fatty acid production occurs in Salmo trutta subjected to hypoxia. This study was undertaken to determine whether or not lactate and/or free short-chain fatty acid production occurs in catfish exposed to gradual environmental hypoxia. Anaerobic responses were studied in both warm (20°C) and cold (5°C) acclimated catfish, in order to assess the differences in anaerobic responses resulting from thermal acclimation. Hypoxia was induced by lowering the oxygen tension of water approximately 9 mm Hg. at half hour intervals, from 147 mm Hg down to 0 mm Hg. Skeletal muscle and liver were analyzed for lactate, pyruvate, and free short-chain fatty acids. The metabolic response of warm acclimated catfish during gradual hypoxia was an increase in lactate production in both muscle and liver. The shift from aerobic to anaerobic metabolism (as determined by an increased lactate/pyruvate ratio) occurred gradually in muscle and liver at approximately the same ambient oxygen tension. No increase in the lactate/pyruvate ratio occurred in muscle or liver of cold acclimated catfish. Pyruvate concentrations did not change significantly in muscle or liver of warm or cold acclimated catfish. No free short-chain fatty acids were found in either tissue of warm or cold acclimated fish. In conclusion, warm acclimated catfish shifted from aerobic to anaerobic metabolism around 20 mm Hg ambient oxygen tension. Cold acclimated catfish did not appear to utilize anaerobic metabolsim under the conditions of this study. (Auth.)

13314. Moser, Byron B., and Don Hicks (Okla. Dept. of Wildl. Conservation, Oklahoma City, Oklahoma). 1970. FISH POPULATION OF THE STILLING BASIN BELOW CANTON RESERVOIR. Proc. Okla. Acad. Sci., 50: 69-74.

A total of 93, 135 fish with a total weight of 12, 857.3 lb. was removed from the stilling basin. Predatory game fish comprised 26.2% of the total number and 34.4% of the total population weight. Substantial populations of harvestable fish were found for nearly all game species. The largemouth bass population was larger than had been expected, consisting of an estimated 130 fish averaging nearly 1.2 lb. Also, an estimated 773 walleye weighing 874.5 lb. were taken. Of these, 63% were of available size, averaging 1.6 lb. There were large populations of small black crappie and channel catfish, with over 70% of the individuals and 50% of the weight of both species falling into the intermediate size-group. Nonpredatory game fish were an insignificant part of the total stilling basin population, contributing only 3.0% of the total number and 1.5% of the weight. Bluegill and longear sunfish were by far the most abundant, whereas we estimated that the stilling basin contained only 73 green sunfish and 18 orange-spotted sunfish. Nonpredatory food fish were not exceptionally abundant, but they accounted for one-third of the total weight of the population. River carpsuckers were the most abundant fish in this group, but most were smaller, intermediate-size fish. Carp averaging 1.1 lb. were the next most abundant species, and freshwater drum were third. Although they were far less abundant, smallmouth buffalo had an average weight of 3.3 lb. and, therefore, made a significant contribution to the total weight. Black bullheads were almost absent from the basin, with an estimate of only 19. Predatory food fish were an extremely small part of the numbers, but they accounted for 4.1% of the weight. The forage fish group is composed entirely of gizzard shad, more than half of which were in the intermediate size-group.

13315. Cordone, Almo J., and Stephen J. Nicola (Calif. Dept. Fish and Game, Sacramento, California). 1970. HARVEST OF FOUR STRAINS OF RAINBOW TROUT, Salmo gairdnerii, FROM BEARDSLEY RESERVOIR, CALIFORNIA. Calif. Fish and Game, 56(4): 271-287.

Four strains of rainbow trout, a wild strain of Kamloops rainbow and three domestic strains utilized in California's catchable trout program, were planted as fingerlings in Beardsley Reservoir, Tuolumme County, from 1961 through 1966. Kamloops and Shastas, the most recently developed domestic strain, were decidedly superior to Whitneys and Virginias, two strains domesticated since near the turn of the century. The best time of the year to plant Kamloops was in April and May when they were 1.0 to 3.2 per ounce. Shastas planted in July and August from 2.5 to 6.2 per ounce were most successful. Comparing groups of these strains planted only at these times we found that Kamloops were harvested at a significantly higher rate than Shastas. Shastas, however, had a higher average ratio of pounds caught to pounds planted, and a lower average cost per pound in the creel. Kamloops displayed a greater tendency to leave the reservoir during periods of spillway discharge, and were less available to shore anglers than the domestic strains. Moreover, they were more difficult to raise in the hatchery. The performance of Shastas we believe, could be greatly improved if they were available for planting at a larger size in the spring. (Authors)

13316. Burns, James W. (Calif. Dept. Fish and Game, Sacramento, California). 1970. SPAWNING BED SEDIMENTATION STUDIES IN NORTHERN CALIFORNIA STREAMS. Calif. Fish and Game, 56(4): 253-270.

Changes in the size composition of spawning bed materials in six coastal streams were monitored for 3 years to determine the effects of logging on the habitat of silver salmon Oncorhynchus kisutch and trout Salmo gairdnerii gairdnerii and S. clarkii clarkii. Four test streams were sampled before, during and after logging. Two streams in unlogged watersheds and the undisturbed upstream section of one test stream served as controls. A variety of stream types in second-growth and old-growth forests was selected for observation. Spawning bed composition in the four test streams changed after logging, roughly in proportion to the amount of streambank disturbance. The heaviest sedimentation occurred when bulldozers operated in narrow stream channels having pebble bottoms. In a larger stream with a cobble and boulder bottom, bulldozer operations in the channel did not increase sedimentation greatly. Sustained logging and road construction kept sediment levels high in one stream for several years. Sedimentation was greatest during periods of road construction near streams and removal of debris from streams, confirming the need for special measures to minimize erosion during such operations. Control streams changed little in spawning bed composition during the 3 years. (Auth.)

13317. Mitchell, Charles I., and John R. Hunter (Calif. Inst. of Technology, Pasadena, California). 1970. FISHES ASSOCIATED WITH DRIFTING KELP, Macrocystis pyrifera, OFF THE COAST OF SOUTHERN CALIFORNIA AND NORTHERN BAJA CALIFORNIA. Calif. Fish and Game, 56(4): 288-297.

Fifty collections of fishes associated with drift-kelp were made offshore of southern California and Baja California, Mexico, with a miniature purse seine. Twenty-one species and 15 families of fishes were represented. Juvenile stages predominated, adults of only seven of the species were captured. The body coloration of the species was related to the distance they usually maintained from the drifting kelp plant. Darker colored species remained closer to the kelp than did silvery ones. Most species were probably recruited in the pelagic environment. A laboratory experiment on the effectiveness of kelp in reducing predation indicated that fishes associated with kelp, were pursued less often, for shorter periods, and captured less frequently by a predator. (Authors)

13318. Bross, Michael G. (Okla. Fish. Res. Lab., Norman, Oklahoma). 1969. FISH SAMPLES AND YEAR-CLASS STRENGTH (1965-1967) FROM CANTON RESERVOIR, OKLAHOMA. Proc. Okla. Acad. Sci., Vol. 48: 194-199.

13319. Richardson, William M., James A. St. Amant, Lawrence J. Bottroff, and Wayne L. Parker (Dept. Fish and Game, Sacramento, California). 1970. INTRODUCTION OF BLUE CATFISH INTO CALIFORNIA. Calif. Fish and Game, 56(4): 311-312.

On October 23, 1969, 1,990 catfish Ictalurus furcatus, were flown from Stuttgart, Arkansas for introduction into Lake Jennings, San Diego County. (Authors)

13320. Washington, Percy M. (Bur. Comm. Fish., Seattle, Washington). 1970. OCCURRENCE ON THE HIGH SEAS OF A STEELHEAD TROUT IN ITS NINTH YEAR. Calif. Fish and Game, 56(4): 312-314.

A steelhead trout, Salmo gairdnerii, of unusual age was taken on September 11, 1969 about 100 miles south of the Shumigan Islands, Alaska. Age determination was made from scale impressions. (Auth.)

13321. Moyle, Peter (Fresno State Coll., Fresno, California). 1970. OCCURRENCE OF KING (CHINOOK) SALMON IN THE KINGS RIVER, FRESNO COUNTY. Calif. Fish and Game, 56(4): 314-315.

On April 3, 1970 three small salmon Oncorhynchus tshawytscha, were taken from Mill Creek a tributary of the Kings River. Salmon have not been reported in the river since 1942. During high water years it is apparently possible for salmon to enter the Kings River system in limited number. (Auth.)

13322. Burton, Dennis T. (Virginia Polytechnic Inst., Blacksburg, Virginia). 1970. LACTIC AND PYRUVIC ACID CHANGES IN BLUEGILL SUNFISH (Lepomis macrochirus Rafinesque) DURING GRADUAL HYPOXIA AT TWO ACCLIMATION TEMPERATURES (5° AND 20°C). Assoc. Southeastern Biol. Bull., 17(2): p. 35.

One of the most characteristic responses to anaerobic conditions by vertebrate animals is the accumulation of lactic acid in the tissues and body fluids. This study was undertaken to investigate the changes in skeletal muscle and liver lactate and pyruvate concentrations during the development of hypoxia. Two groups of 15-20 cm bluegills were tested at their acclimation temperatures - at 20°C during August and September; at 5°C during November and December. Experimental fish were exposed to a gradual eight-hour hypoxic stress in continuous flow test chambers/ Dissolved oxygen concentrations were reduced in steps at half hour intervals from saturation to zero concentrations. Skeletal muscle and liver from at least eight fish at seven different oxygen concentrations were analyzed for lactic and pyruvic acid. At each temperature lactic acid increased in both muscle and liver at very low oxygen concentrations; the pyruvic acid concentration was relatively constant throughout. Thus the lactate/pyruvate ratio increased at low oxygen concentrations. This indicates a shift to anaerobic metabolism in these tissues. Lactic acid concentrations were significantly higher at 20°C than at 5°C. Pyruvic acid concentrations were similar at both temperatures. Fish at 5°C could tolerate lower oxygen concentrations than those at 20°C. The data suggest that acclimation to cold temperatures has survival value for fish exposed to hypoxia. (Auth.)

13323. McKechnie, Robert J., and Lee W. Miller (Dept. Fish and Game, Sacramento, California). 1971. THE STRIPED BASS PARTY BOAT FISHERY: 1960-1968. Calif. Fish and Game, 57(1): 4-16.

Striped bass Morone saxatilis full-day party boat records are analyzed and compared with earlier trends in the fishery. Angler success reached an all-time high for north San Francisco Bay during the 1960-63 period and then began to decline. Success in the other major areas generally declined throughout the study period. The average size of bass in the catch increased markedly. The data strongly suggest a decline in numbers of bass, although the biomass caught per angler day has remained relatively stable during the period of decline. (Authors)

13324. Cohen, Daniel M. (Bur. of Comm. Fish., Washington, D. C.). 1970. HOW MANY RECENT FISHES ARE THERE? Proc. Calif. Acad. Sci., 4th Series, 38(17): 341-346.

Estimates of the number of species of Recent fishes are presented.

13325. Cordone, Almo J., Stephen J. Nicola, Phillip H. Baker, and Ted C. Frantz (Dept. Fish and Game, Sacramento, California). 1971. THE KOKANEE SALMON IN LAKE TAHOE. Calif. Fish and Game, 57(1): 28-43.

Large numbers of kokanee salmon, Oncorhynchus nerka, fry were stocked in Lake Tahoe from 1949 through 1955. Kokanee became established but the population remained at a low level until 1963 when a dramatic increase in the number of spawners was observed. A fishery finally developed in 1967. Major spawning concentrations occur in Taylor Creek and along the shores of McKinney Bay. In most years from 1960 through 1968 virtually the entire Tavlor Creek run was composed of a single age group from certain strong year classes. Presence of strong year classes suggests high survival of naturally-spawned fish. There is some evidence, however, of high egg retention. Lake Tahoe kokanee grow rapidly and a trend toward increasing growth rates since 1961 is suggested. Their length-weight relationship was log W=-3.26090 + 2.91063 log L. Their diet consisted mostly of cladocerans. They are widely distributed in the limnetic zone and strongly surface oriented, except during the summer and early fall when large schools form off Taylor Creek at depths from 50 to 120 ft. (Authors)

13326. Burns, James W. (Dept. Fish and Game, Sacramento, California). 1971. THE CARRYING CAPACITY FOR JUVENILE SALMONIDS IN SOME NORTHERN CALIFORNIA STREAMS. Calif. Fish and Game, 57(1): 44-57.

Standing crops of juvenile coho (silver) salmon, Oncorhynchus kisutch, steelhead rainbow trout, Salmo gairdneri, and coast cutthroat trout, Salmo clarki, were examined in seven coastal streams to define the natural carrying capacity of these streams, and to develop methods of population comparison and prediction which could be used to determine the effects of road construction and logging on salmon and trout production. Biomass per unit of surface area was the best method of expressing carrying capacity, because biomass was better correlated with stream surface area than with other parameters tested. Volume of streambed sediments, total dissolved solids, alkalinity, and total phosphate in six streams were not satisfactory predictors of carrying capacity. Only living-space variables correlated significantly with biomass. Not all streams reached carrying capacity in the summer and salmonid biomass was highly variable. Even with 3 years of prelogging study, it would be difficult to attribute a change in carrying capacity under 50% to anything but natural variation. (Auth.)

13327. Ehrlich, Karl F., and David A. Farris (Dept. Biol., San Diego State Coll., San Diego, California). 1971. SOME INFLUENCES OF TEMPERATURE ON THE DEVELOPMENT OF THE GRUNION Leuresthes tenuis (Ayres). Calif. Fish and Game, 57(1): 58-68.

The effect of temperature upon the development of the grunion, was studied throughout the spawning season of the fish. The viable range for hatching was determined to be 14.0-28.5 C. Developmental temperature coefficients were calculated for hatching, lens formation, eye pigmentation, heart beating, and embryonic axis formation. These were equal for all of the characteristics, but two distinct ones were found within the viable range, -0.0613 from 14.0-23.0 C and -0.0113 from 23.0-28.5 C. A temperature coefficient for maintenance of -0.0221 was determined for the grunion during the period after it is ready to hatch but before it is freed from the sand. The maximum percentage of hatching was close to 100 between 16.0-27.0 C but dropped off rapidly outside this thermal range. The average length at hatching was not influenced by the degree-hours incubated. The growth rate of larvae at 18.0 C post-hatching was not influenced by the temperature at which they were incubated. (Authors)

13328. Walker, M. Greer, R. B. Mitson, and T. Storeton-West (Ministry of Agr., Fish. and Food, Fish. Lab., Lowestoft, Suffolk, England). 1971. TRIALS WITH A TRANSPONDING ACOUSTIC FISH TAG TRACKED WITH AN ELECTRONIC SECTOR SCANNING SONAR. Nature, 229(5281): 196-198.

13329. Skinner, John E. (Dept. Fish and Game, Sacramento, California). 1971. Anguilla RECORDED FROM CALIFORNIA. Calif. Fish and Game, 57(1): 76-79.

Two specimens of the Family Anguillidae (true eels) have been taken alive in the Sacramento-San Joaquin Delta of California. The first was taken in 1964 by a local fisherman and was identified by Dr. Carl Hubbs of the Scripps Institution of Oceanography as Anguilla rostrata (Le Sueur). The second was captured at a State-operated fish salvage facility on January 24, 1969 and was subsequently identified by Mr. W. I. Follett, Curator of Fishes for the California Academy of Sciences as Anguilla anguilla (Linnaeus). (Auth.)

13330. McPhail, J. D., and C. C. Lindsey (Inst. of Animal Resource Ecology and Dept. of Zool., The Univ. of Brit. Columbia, Vancouver, Brit. Columbia, Canada). 1970. FRESHWATER FISHES OF NORTHWESTERN CANADA AND ALASKA. Fish. Res. Bd. Canada Bull. No. 173, 381 p., illus.

Contents include: Background information... Introduction; Acknowledgments; History of publications on northern freshwater fishes; Outline of geological history; Zoogeographic patterns; Summary of dispersal routes; Classification and nomenclature; Scope of species descriptions; Methods of identifying fishes. Glossary. Use of keys; Key to families. Species accounts... Lampreys - family Petromyzontidae; Sturgeons - family Acipenseridae; Mooneyes - family Hiodontidae; Whitefishes - family Coregonidae; Graylings - family Thymallidae; Trouts, chars, and salmons - family Salmonidae; Smelts - family Osmeridae; Pikes - family Esocidae; Blackfish - family Dalliidae; Minnows - family Cyprinidae; Suckers - family Catostomidae; Trout-Perches - family Percopsidae; Cods - family Gadidae; Sticklebacks - family Cottidae; Perches - family Percidae; Flounders - family Pleuronectidae. Collecting and preserving specimens. References. (From contents)

13331. Gasaway, Charles R. (Bur. Sport Fish. and Wildl., No. Central Reservoir Investigations, Yankton, South Dakota). 1970. CHANGES IN THE FISH POPULATION IN LAKE FRANCIS CASE IN SOUTH DAKOTA IN THE FIRST 16 YEARS OF IMPOUNDMENT. U. S. Dept. of Interior, Bur. of Sport Fisheries and Wildlife Technical Papers, No. 56, 30 p. Available from Supt. of Documents, U. S. Govt. Printing Office, price $.35.

The total number of adult fish in Lake Francis Case, a main stem Missouri River Reservoir, has declined since impoundment in 1952. Goldeye, channel catfish, and northern redhorse have probably remained the same; emerald shiner, white bass, walleye, and possibly flathead catfish have increased. The sauger population began to decline at about the time walleye numbers increased. Some species formerly present in small numbers have become rare; flathead chub, stonecat, black bullhead, largemouth bass, green sunfish, orangespotted sunfish, and bluegill. The catch rate by sport fishermen in the reservoir declined from 1954 to 1960. Growth of northern pike, river carpsucker, largemouth bass, walleye, and sauger was faster than in most other U. S. waters at this latitude; carp and freshwater drum growth was slower. For 13 species for which preimpoundment growth estimates were available, growth increased after impoundment but later declined. Forage species in the reservoir were gizzard shad, emerald shiner, and yellow perch, but these were not present in large enough numbers to provide an abundant forage fish population. Echo sounding and midwater trawling in 1968 indicated that the pelagic zone contained few fish. Reproduction was successful in 1953 and 1954 for gizzard shad, goldeye, northern pike, most catostomids, carp, most centrarchids, sauger, and drum; reproduction was good for many species in 1967, a year of high water levels; reproduction of walleye, white bass, drum, and emerald shiner was more successful in 1966-68 than in most previous years. (Auth.)

13332. Denton, Eric. 1971. REFLECTORS IN FISHES. Scientific American, 224(1): 65-72.

Many fishes are able to secrete nitrogenous compounds that form mirror-like layers of reflective crystals. In the scales and the skin the layers are displays or camouflage; elsewhere they aid vision.

13333. Day, Donald (Natl. Mar. Fish. Serv. Biol. Lab., Seattle, Washington). 1971. MACROZOOPLANKTON AND SMALL NEKTON IN THE COASTAL WATERS OFF VANCOUVER ISLAND (CANADA) AND WASHINGTON. SPRING AND FALL OF 1963. U. S. Dept. Commerce, NOAA, NMFS, Spec. Scientific Report - Fisheries No. 619, 94 p.

Eight species of euphausiids, 5 species of mysids, and 14 species of fish were identified. Euphausiids composed about 90 percent by number of the organisms caught, and fluctuations in their abundance were concomitant with changes in the biomass of the samples. The bulk of the organisms collected at night were in the upper 30 m. All apecies were taken by a 0.9-m. Isaacs-Kidd midwater trawl. The concentration of organisms was lowest near shore, reached a maximum at or near the outer edge of the continental shelf, and decreased again farther offshore. The concentration of organisms was greater in the southern part of the region than in the northern part. This distribution was apparently related to the general surface circulation. Seasonal fluctuations were indicated by a decrease in biomass from spring to fall. (Auth.)

13334. Bartnik, Victor G. (Dept. of Zoology, Univ. of Manitoba, Winnipeg, Man., Canada). 1970. REPRODUCTION ISOLATION BETWEEN TWO SYMPATRIC DACE, Rhinichthys atratulus AND R. cataractae, IN MANITOBA. J. Fish. Res. Bd. Canada, 27(12): 2125-2141.

The Mink and Valley rivers, Manitoba, contain two sympatric species of dace (Cyprinidae: Rhinichthys). These fishes, although interfertile, have never been reported to hybridize in nature. Seasonal isolation is only partially developed, since overlap in time of spawning exists. During spawning, adults of the two species tend to occupy different habitats, the Great Lakes longnose dace Rhinichthys cataractae cataractae being most abundant in water velocities faster than 45 cm/sec and the western blacknose dace R. atratulus meleagris in water velocities less than 45 cm/sec; but some overlap exists. However, the place of spawning of the two species is distinctly different. Nests of longnose dace were found in water velocities exceeding 45 cm/sec with large stones, whereas nests of blacknose dace were found in slower water velocities in gravel. The patterns of spawning behaviour of these two cyprinids reveal marked differences and obvious incompatibilities. Males of both species actively defend territories prior to spawning but show distinct preferences for conspecific females over other females. Observations further indicate that females are receptive only to patterns of courtship behaviour shown by males of their own species. The combination of different places of spawning and patterns of behaviour is considered to be a powerful barrier to hybridization. (Auth.)

13335. Ennis, G. P. (Fish. Res. Bd. Canada Biol. Sta., St. John's, Newfoundland, Canada). 1970. AGE, GROWTH, AND SEXUAL MATURITY OF THE SHORTHORN SCULPIN, Myoxocephalus scorpius, IN NEWFOUNDLAND WATERS. J. Fish. Res. Bd. Canada, 27(12): 2155-2148.

In Newfoundland waters, shorthorn sculpins, Myoxocephalus scorpius (L.), live to age 15 and attain a miximum size of just over 50 cm. The growth rates of males and females are little different below age 4, but above age 4 the females grow faster than the males, and the difference between average length-at-age for males and females gets progressively larger with age. Males mature at a younger age and at a smaller size than females. In any age-group where there are mature and immature individuals the mature ones are larger. (Auth.)

13336. Kabata, Z. (Fish. Res. Bd. Canada Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1970. DISCOVERY OF Brachiella lageniformis (COPEPODA: LERNAEOPODIDAE) IN THE CANADIAN PACIFIC AND ITS SIGNIFICANCE TO ZOOGEOGRAPHY OF THE GENUS Merluccius (PISCES: TELEOSTEI). J. Fish. Res. Bd. Canada, 27(12): 2159-2165.

Brachiella lageniformis, hitherto known only from the Atlantic coast of Argentina, was found off the east coast of Vancouver Island, on the gills of Merluccius productus. Both male and female are described and illustrated in detail. The

significance of this find for Szidat's views on the origin of the genus Merluccius is discussed. A proposal is made to suppress the genus Parabrachiella and to place all its five species (P. rostrata, P. insidiosa, P. australis, P. spinicephala, and P. incurva) in the genus Brachiella. (Auth.)

13337. Chen, F. Y., and H. Tsuyuki (Trop. Fish. Cult. Res. Inst., Malacca, W. Malaysia). 1970. ZONE ELECTROPHORETIC STUDIES ON THE PROTEINS OF Tilapia mossambica AND T. hornorum AND THEIR F_1 HYBRIDS, T. zillii, AND T. melanopleura. J. Fish. Res. Bd. Canada, 27(12): 2167-2177.

Starch-gel electrophoretic characteristics of the hemoglobins, muscle myogens, serum transferrins, and serum esterases from two species of mouth brooders, T. mossambica Peters and T. hornorum Trewavas, and two species of substratum spawners, T. zillii Gervais and T. melanopleura Dumeril, are described in detail. The mobility characteristics of lactate dehydrogenases (LDH) from 11 tissues of these four species are also described. The two mouth brooders possess virtually identical LDH zymograms, whereas the unique mobility difference of the skeletal muscle type subunit distinguishes T. zillii from T. melanopleura and from the two mouth brooders. The LDH subunit specific for the eye tissue comprised the major diagnostic feature distinguishing the mouth brooders and the substratum spawners. No mobility differences in serum esterases were found between the two substratum spawners, whereas the mouth brooders did possess different mobilities. Tilapia mossambica possessed a single serum transferrin zone, and T. hornorum one major and one minor zone. The hemoglobins and muscle myogens completely separated all four species of Tilapia indicating that these are the protein groups of choice as diagnostic tools in their identification. These proteins are likewise sufficiently diagnostic to point out that the specimens of T. mossambica and particularly T. hornorum used in these studies were not always biochemically uniform, emphasizing their further value in the selection of parental stocks for breeding purposes. The need for new approaches such as these for supplementing the classical morphometric techniques in fish farming is outlined. (Authors)

13338. Gardiner, George R., and Paul P. Yevich (Fed. Qual. Contr. Admn., Natl. Mar. Water Qual. Lab., West Kingston, Rhode Island). 1970. HISTOLOGICAL AND HEMATOLOGICAL RESPONSES OF AN ESTUARINE TELEOST TO CADMIUM. J. Fish. Res. Bd. Canada, 27(12): 2185-2196.

Pathological changes attributable to cadmium poisoning were observed in the intestinal tract, the kidney, and the gills of Fundulus heteroclitus after exposure to 50 ppm of the metal. Microscopic examination revealed pathological changes of the intestinal tract as early as 1 hr after exposure, in the kidney after 12 hr, and in the gill filaments and respiratory lamellae after 20 hr. These manifestations of cadmium poisoning bear resemblance to the pathological changes that have been demonstrated clinically and experimentally in mammals. The examination of circulating blood elements revealed rapid and striking changes among cells of the eosinophil lineage. The abundance of eosinophils increased steadily to a level approximately 45% above the usual amount. Indications of the cellular increase occurred as an early rise 4 hr after exposure. A reduction in the relative numbers of mature eosinophils was evident in imprints of head kidney tissue. Nuclear anomalies were associated with the thrombocytes of specimens after 8 hr exposure; however, these changes were not noticeable at either earlier or later time periods. (Authors)

13339. McFadden, T. W. (Lab. for Experimental Limnology, R. R. #2, Maple, Ontario, Canada). 1970. FURUNCULOSIS IN NONSALMONIDS. J. Fish. Res. Bd. Canada, 27(12): 2365-2370.

Natural furunculosis infection in a group of bait and other nonsalmonid fishes in southern Ontario is described. The source of infection, although not positively identified, appears to have been derived from an adjacent stream or from infected crayfish. (Auth.)

13340. Withler, F. C., and R. B. Morley (Fish. Res. Bd. Canada Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1970. SEX-RELATED PARENTAL INFLUENCES ON EARLY DEVELOPMENT OF PACIFIC SALMON. J. Fish. Res. Bd. Canada, 27(12): 2197-2214.

Among the fertilized eggs arising from a series of intraspecific and interspecific crosses involving sockeye, pink, and chum salmon, time from fertilization to hatching was longest for crosses involving sockeye males, less for those involving pink males, and least for those involving chum males. For crosses of females of the three species with males of a single species, eggs from pink females took longest to hatch, those from sockeye females took less time, and those of chums took the least. Larva size at hatching was greatest for larvae emerging from chum eggs, irrespective of male parent, less for those emerging from sockeye eggs, and least for those from pink eggs. There were only small differences in the size of larvae at hatching from the eggs of females of one species that had been fertilized by males of each of the three species. Among the pre-hatched embryos developing in eggs of a single species, those with a sockeye male parent grew slowest, those with a pink male parent grew faster, and those involving a chum male parent fastest. In eggs from females of the three species fertilized by the males of one species, embryos in eggs of chum females grew fastest, those in eggs of sockeye females slower, and those in eggs of pink females slowest. Gross malformation among hybrid offspring was not pronounced - only chum male X sockeye female and chum male X pink female hybrids displayed markedly greater proportions of malformed individuals than did the combined intraspecific crosses involving the same parents. It is possible that observed differences in time from fertilization to hatching between eggs of different parental origin are brought about by the interaction of growth rates inherited mainly from the male parents and a critical embryo size related to the size of eggs of the female parent. Identification of parental determinants of early development of salmon should make it possible to create salmon forms capable of exploiting new or changed environments. (Authors)

13341. Winters, G. H. (Fish. Res. Bd. Canada Biol. Sta., St. John's, Newfoundland, Canada). 1970. BIOLOGICAL CHANGES IN COASTAL CAPELIN FROM THE OVER-WINTERING TO THE SPAWNING CONDITION. J. Fish. Res. Bd. Canada, 27(12): 2215-2224.

Regular research vessel surveys in Trinity Bay, Nfld., during 1967-68 indicated that significant biological changes occurred in coastal capelin from the over-wintering to the spawning period. During their over-wintering period in February-March mature capelin had a high fat content, a low feeding intensity, a low nematode incidence, and were heavy at length. The gonads were in a resting stage, secondary sexual characteristics were absent, and the sexes were integrated. During the prespawning period in April-May the feeding intensity increased and the gonads and secondary sexual characteristics began to develop, whereas the fat content declined. At this time the schools were segregated by sex. By the start of the spawning season in mid-June the capelin had ceased feeding, the fat content was low, and the weight at any particular length was less than that during the over-wintering period. The incidence of nematodes was high and the sexes were readily distinguished by the conspicuous secondary sexual characteristics. These changes are discussed in relation to the seasonal distribution pattern of coastal capelin in Trinity Bay and the feasibility of a commercial fishery. (Auth.)

13342. Grant, Blake F., and Paul M. Mehrle (Fish-Pesticide Res. Lab., Bur. Sport Fish. and Wildl., Columbia, Missouri). 1970. CHRONIC ENDRIN POISONING IN GOLDFISH, Carassius auratus. J. Fish. Res. Bd. Canada, 27(12): 2225-2232.

Endrin incorporated into the diet of mature male goldfish for 3-4 months affected growth, gonad development, thyroid activity, serum characteristics, total and differential body fat, behavior, and mortality. A biphasic response to endrin dosage was characteristic. The low doses (4.3-43 μg/kg body weight per day) either caused no detectable effect or were stimulatory, as seen from increased rates of growth and higher total body fat contents. The two highest doses (143 and 430 μg) caused mortality, lowered growth rates, and other chronic symptoms of endrin intoxication;

they also caused decreased thyroid cell heights, decreased gametogenesis, and lowered total body fat, as well as less vacuolization in liver cells. All doses except the highest caused elevated serum Na concentrations. The fish receiving the highest dose suffered osmoregulatory failure. Induced spermiation was not affected; fish receiving 143 or 430 µg/kg had greatly reduced, but functional testes. (Authors)

13343. Tsuyuki, H., and S. J. Westrheim (Fish. Res. Bd. Canada, Vancouver Lab., Vancouver 8, Brit. Columbia, Canada). 1970. ANALYSES OF THE Sebastes aleutianus-S. melanostomus COMPLEX, AND DESCRIPTION OF A NEW SCORPAENID SPECIES, Sebastes caenaematicus, IN THE NORTHEAST PACIFIC OCEAN. J. Fish. Res. Bd. Canada, 27(12): 2233-2254.

Taxonomic studies, based on biochemical and physical morphology, of the Sebastes aleutianus-S. melanostomus complex (family Scorpaenidae) resulted in the identification and description of new species, Sebastes caenaematicus, whose known range is Cape Flattery, Washington, to Cape Ommaney, Alaska. A synonymy and literature history for the complex is presented. (Authors)

13344. Hurlburt, E. M. (Woods Hole Oceanographic Inst., Woods Hole, Massachusetts). 1970. RELATION OF HEAT BUDGET TO CIRCULATION IN CASCO BAY, MAINE. J. Fish. Res. Bd. Canada, 27(12): 2255-2260.

A description of the temperature and humidity characteristics of the air over the water in Casco Bay shows that in summer the air warmed the cool surface water. Solar radiation, however, was much greater than the exchange between air and water. When added together the heat gains from sun and air exceeded by a large amount the heat gain derived from the observed temperature increase in the water mass of the Bay. Cold, deep water must have entered the Bay from outside, and must have been mixed upward by tidal currents about the islands, thus replacing the warm bay water. (Auth.)

13345. Pitt, T. K. (Fish. Res. Bd. Canada Biol. Sta., St. John's, Newfoundland, Canada). 1970. DISTRIBUTION, ABUNDANCE, AND SPAWNING OF YELLOWTAIL FLOUNDER, Limanda ferruginea, IN THE NEWFOUNDLAND AREA OF THE NORTHWEST ATLANTIC. J. Fish. Res. Bd. Canada, 27(12): 2261-2271.

Yellowtail flounder were found as far north as the Strait of Belle Isle; however, the main concentrations were located on Grand and St. Pierre banks. The highest concentrations were found at 31-35 fath (47-64 m) and temperatures of 3.1-4.8 C. Abundance on the Grand Bank apparently increased from 1961 to 1968 coincident with a general upward trend in bottom temperatures and a drastic reduction in the haddock population. The peak spawning period was the latter half of June. Fifty percent of the males were sexually mature at age 5 and 31 cm, and 50% of females at age 6 and 37 cm. (Auth.)

13346. Donaldson, Edward M., and Ulf H. M. Fagerlund (Fish. Res. Bd. Canada West Vancouver Lab., West Vancouver, Brit. Columbia, Canada). 1970. EFFECT OF SEXUAL MATURATION AND GONADECTOMY AT SEXUAL MATURITY ON CORTISOL SECRETION RATE IN SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 27(12): 2287-2296.

Changes in cortisol dynamics in male and female sockeye salmon (Oncorhynchus nerka) have been investigated at various stages during sexual maturation, after spawning, and after gonadectomy just prior to their reaching sexual maturity. The metabolic clearance rate of cortisol was determined by the single injection technique and calculated using the formula for a two-pool system. The volume of distribution of cortisol in the inner pool and the outer pool, metabolic clearance rate, and cortisol secretion rate increased in both male and female salmon during sexual maturation. These changes were reversed in fish that were gonadectomized just before reaching functional maturity and allowed to recuperate for 2 or 8 weeks. There was a decrease in the amount of red carotenoid pigment in the flesh of salmon held in the laboratory during sexual maturation. This loss of pigment was reversed in salmon that were gonadectomized and fed marine zooplankton for 8 weeks. (Authors)

13347. Fagerlund, Ulf H. M., and Edward M. Donaldson (Fish. Res. Bd. Canada, Vancouver Lab., Vancouver 8, Brit. Columbia, Canada). 1970. DYNAMICS OF CORTISONE SECRETION IN SOCKEYE SALMON (Oncorhynchus nerka) DURING SEXUAL MATURATION AND AFTER GONADECTOMY. J. Fish. Res. Bd. Canada, 27(12): 2323-2331.

Indices of cortisone secretion in sockeye salmon (Oncorhynchus nerka) were determined by monitoring the disappearance of labelled cortisone in plasma after the injection of a single dose of 4-^{14}C-cortisone. Cortisone concentrations were determined by a protein-binding method. The volume of distribution in the inner (V_1) and outer (V_2) pool, biological half-life (T 1/2), metabolic clearance rate (MCR), plasma concentration, and secretion rate of cortisone increased with sexual maturation, except cortisone concentration in males during anaesthetic stress. Differences between sexually immature fish and fish matured in captivity were generally significant ($P < 0.05$). After gonadectomy of mature fish the return of the changes observed resembled qualitatively those of cortisol dynamics. In sexually mature and spawned fish, cortisone concentrations and secretion rates, did not increase during anaesthetic stress in contrast to those of cortisol, suggesting that the full capacity of the cortisone secretion mechanism had already been reached in the resting state. Cortisone secretion rates were similar in magnitude to those of cortisol in resting fish, but cortisol secretion rates were two to four times higher than those of cortisone during anaesthetic stress. (Authors)

13348. Woodhead, P. M. J. (Mar. Sci. Res. Lab. and Dept. of Biol., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1970. AN EFFECT OF THYROXINE UPON THE SWIMMING OF COD. J. Fish. Res. Bd. Canada, 27(12): 2337-2338.

Cod treated with the hormone thyroxine, and held in a large aquarium, swam 35% faster than saline-treated controls held in the same conditions. The difference in swimming activity of the two groups was highly significant. (Auth.)

13349. Bulow, Frank J. (Iowa Coop. Fish. Unit, Dept. of Zool. and Entom., Iowa State Univ., Ames, Iowa). 1970. RNA-DNA RATIOS AS INDICATORS OF RECENT GROWTH RATES OF A FISH. J. Fish. Res. Bd. Canada, 27(12): 2343-2349.

When golden shiners (Notemigonus crysoleucas) were fed at 0, 2, and 6% body weight for 15 days, the mean RNA-DNA ratios for defatted tissues (whole, eviscerated fish) were 2.18, 2.83, and 4.32, respectively, in association with mean weight changes of -16.1, 2.2, and 21.3%. Food deprivation for 30 and 45 days resulted in mean ratios of 1.66 and 1.36, in association with mean weight losses of 20.6 and 35.6% body weight. Feeding at 2% body weight for 30 and 45 days resulted in a leveling off of ratios (3.15 and 3.03 respectively) with a continued gain in body weight (19.9 and 45.6%); feeding at the 6% rate for the same durations resulted in a decline in ratios (3.91 and 3.08, respectively) with a continued gain in body weight (57.9 and 90.9%). Depriving golden shiners of food for 14 days and then resuming feeding for 6 days demonstrated that RNA-DNA ratios change rapidly, the changes being attributed primarily to changes in RNA concentrations. Mean ratios declined from 3.56 after 4 days to 2.30 after 14 days of food deprivation. When feeding was resumed, ratios averaged 3.45, 4.93, 5.07, 5.73, 5.00, and 5.14 after 1-6 days feeding, respectively. (Auth.)

13350. Smith, R. J. F. (Dept. of Biol., Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada). 1970. EFFECTS OF FOOD AVAILABILITY ON AGGRESSION AND NEST BUILDING IN BROOK STICKLEBACK (Culaea inconstans). J. Fish. Res. Bd. Canada, 27(12): 2350-2355.

Male brook stickleback (Culaea inconstans) that were fed 50 brine shrimp per day built nests under conditions that prevented nest building in fish fed 10 or 30 brine shrimp per day. Groups of fish fed 50 brine shrimp per day or with live food present continuously were more aggressive and territorial than the same fish when unfed. (Auth.)

13351. Jenkins, T. M., Jr., C. R. Feldmeth, and G. V. Elliott (Bur. Sport Fish. and Wildl., Sierra Nevada Aquatic Res. Lab., Rte. 3, Box 198, Bishop, California). 1970. FEEDING OF RAINBOW TROUT (Salmo gairdneri) IN RELATION TO ABUNDANCE OF DRIFTING INVERTEBRATES IN A MOUNTAIN STREAM. J. Fish. Res. Bd. Canada, 27(12): 2356-2361.

Hatchery-reared rainbow trout, deprived of food for 48 or 96 hr and released in a mountain stream for 5- or 10-hr periods, consumed aerial invertebrates in numbers loosely associated with their seasonal and hourly abundance in the drift. The same was generally true for benthic insects, except that on several days feeding was much poorer relative to drift from 3:00 AM to 8:00 AM than at other times of day. In September and October tests, aerial forms were abundant during daylight, and benthic forms abundant at night, enabling trout to feed 24 hr a day. Day and night feeding in September were roughly equal in importance, but in October more food was taken during the day. Aerial invertebrates were so rare in December that benthic insects were the most important prey day and night. However, even benthics were not numerous enough to provide good feeding. (Authors)

13352. Utter, Fred M., Warren E. Ames, and Harold O. Hodgins (Bur. of Comm. Fish., Biol. Lab., Seattle, Washington). 1970. TRANSFERRIN POLYMORPHISM IN COHO SALMON (Oncorhynchus kisutch). J. Fish. Res. Bd. Canada, 27(12): 2371-2373.

Six transferrin phenotypes observed in sera of coho salmon (Oncorhynchus kisutch) were interpreted as a reflection of three alleles — Tf^A, Tf^B, and Tf^C — at a single locus. The distribution of these alleles differed significantly among samples collected from streams entering Puget Sound and tributaries of the Columbia River, suggesting a potential usefulness of this system for stock identification. (Authors)

13353. Smith, Roderick M., and Charles F. Cole (Dept. of Forestry and Wildl. Management, Univ. of Mass., Amherst, Massachusetts). 1970. CHLORINATED HYDROCARBON INSECTICIDE RESIDUES IN WINTER FLOUNDER, Pseudopleuronectes americanus, FROM THE WEWEANTIC RIVER ESTUARY, MASSACHUSETTS. J. Fish. Res. Bd. Canada, 27(12): 2374-2380.

Residues of DDT, heptachlor, and dieldrin were found in tissues of winter flounder, Pseudopleuronectes americanus (Walbaum), from the Weweantic River estuary, Massachusetts during 1966-67. In nonmigratory juveniles, seasonal accumulation patterns were demonstrated for DDT, heptachlor, and two related breakdown products, DDE and heptachlor epoxide. Peak concentrations of the parent compounds were more closely associated with high runoff conditions than any specific application in the estuarine drainage. Dieldrin was present uniformly throughout the year. Migratory adult flounder, present only between October and May, contained heptachlor and heptachlor epoxide levels similar to juveniles, but significantly less DDE. Adult female flounder sequentially concentrated DDT, DDE, and heptachlor epoxide in their ripening ovaries as the spawning season approached. (Authors)

13354. Lie, Ulf, and Dale S. Kisker (Dept. of Oceanography, Univ. of Wash., Seattle, Washington). 1970. SPECIES COMPOSITION AND STRUCTURE OF BENTHIC INFAUNA COMMUNITIES OFF THE COAST OF WASHINGTON. J. Fish. Res. Bd. Canada, 27(12): 2273-2285.

13355. Olifer, S. A. 1970. ON THE RESULTS OF ACCLIMATIZATION OF FISH IN BRATSKOE RESERVOIR. (O rezul'tatakh akklimatizatsii ryb v Bratskom Vodokhranilishche). Rybnoe Khozyaĭstvo, No. 9, pp. 18-20. In Russian.

In order to improve the qualitative composition of the ichthyofauna and increase fish productivity in Bratskoe Reservoir, 9 species of fish were stocked during the period from 1962 through 1969. However, the expected result was not obtained from populating the reservoir with valuable species of fish. This is explained primarily by insufficiently sound selection of the objects for stocking, by disruption of the biological requirements with massive plantings of valuable fishes, and in addition by the fact that the factor of interspecific relations of settlers and aborigines was not taken into consideration.

13356. Ghittino, P. (Istituto Zooprofilattico Sperimentale del Piemonte e Liguria, Via Bologna, 148 - 10154 Torino, Italy). 1970. THE CULTURE OF BAIT FISHES IN THE U. S. A. Riv. It. Piscic. Ittiopat., 5(3):51-56.

The author emphasizes the importance represented by the bait fish culture in the Southern States of the U. S. A., particularly in Arkansas. Such fish culture may be inconceivable to the European fish growers, since sport fishery in Europe is not so seriously considered as in America. He stresses the actual and potential economic aspects of bait fish raising, reporting examples of some huge enterprises existing in Arkansas, as f. i. the "Anderson's Minnow Farm, Lonoke, Arkansas". The characteristics of three main fish species (golden shiners, Notemigonus crysoleucas; fathead minnow, Pimephales promelas; goldfish, Carassius auratus) are briefly illustrated, as well as their propagation methods (wild or free spawning method, egg transfer method, fry transfer method), fry rearing, natural and artificial nutrition, etc. (as suggested by the "Warmwater Fish Cultural Research Laboratories, Stuttgart, Arkansas, USA"). The author concludes with a short review on the principal disease that may trouble this new kind of fish culture (bacterial-, protozoan-, worm-, crustacean-diseases).

13357. Kocylowski, B., J. Antychowicz, J. Zelazny (Veterinary Research Istitute, Dept. of Fish Diseases, Pulawy, Poland). 1970. STUDIES ON THE ETIOLOGY AND PATHOGENESIS OF CARP SWIM BLADDER INFLAMMATION. Riv. It. Piscic. Ittiopat., 5(3): 59-63.

The carp swimbladder has the ability to resorb liquids through the inner epithelium. Inoculation of Aeromonas and Pseudomonas bacteria directly to the lumen of the swimbladder resulted in inflammation of this organ and lesions identical to the ones observed in naturally occurring swimbladder disease in carp. The intensity of the inflammation depends on the bacteria number used in inoculum as well as the kind of the liquid used for suspension. Reinfection resulted in advanced incurable pathological lesions. When fish are put in good environmental conditions without possibility of reinfection the first two stages of swimbladder disease can recede. Inherited smallness of the posterior swimbladder chamber is a predisposing factor for this disease. (Authors conclusions)

13358. Thomas, Nelson A. (Natl. Field Investigations Center, Fed. Wat. Qual. Admn., U. S. Dept. of the Interior, Cincinnati, Ohio). 1970. IMPOUNDMENT BIOLOGY OF WILSON RESERVOIR, KANSAS. J. Amer. Wat. Wks Assn., 62(7): 439-443.

Water impounded in Wilson Reservoir, Kansas, was of a higher quality than upstream Saline River water during low flows; this improved water provided for populations of the more preferred phytoplankton and a larger, more diverse and stable population of bottom animals, as well as better environmental conditions for downstream aquatic life. The productivity of Wilson Reservoir was higher during the first year of impoundment because of the leaching of algal nutrients from the inundated soils, but productivity declined following the first year, when bottom sediments were effectively sealed. Phosphorus is the limiting algal nutrient in Wilson Reservoir – as it declined, the decrease in phytoplankton resulted in a decrease in plankton feeding animals. A decline in fish production is expected because phytoplankton and bottom associated organisms are the primary foods of reservoir fish. (Auth. conclusions)

13359. Bogoroditskiĭ, P. V. 1970. ON THE SPAWNING PERIODS OF THE CASPIAN GREY MULLETS. (O srokakh neresta u Kaspiĭskikh kefaleĭ). Rybnoe Khozyaĭstvo, No. 9, pp. 7-8. In Russian.

The decline of the catches of grey mullets along the shores of the Caspian during summer apparently is due to their departure for spawning in open parts of the Sea.

13360. Lunz, G. Robert, and Frank J. Schwartz (Bears Bluff Laboratories, Wadmalaw Island, So. Carolina). 1970. ANALYSIS OF EIGHTEEN YEAR TRAWL CAPTURES OF SEATROUT (Cynoscion sp.: SCIAENIDAE) FROM SOUTH CAROLINA. Contributions from Bears Bluff Laboratories, No. 53, 29 p.

13361. Rozenfel'd, L. S. 1970. THE EFFECT OF BIOSTIMULATORS ON THE GROWTH AND PHYSIOLOGICAL CONDITION OF MARKET FISH. (Vliyanie biostimulyatorov na rost i fiziologicheskoe sostoyanie tovarnoĭ ryby). Rybnoe Khozyaĭstvo, No. 9, pp. 15-16. In Russian.

The addition of the biostimulators lysine and terramycin to feed permits one to increase the average weight of market fish by 30-40%, under production conditions.

13362. Ricker, W. E. 1970. THE BIOSTATISTICAL METHOD OF A. N. DERZHAVIN. PART I. (Biostatisticheskiĭ metod A. N. Derzhavina). Rybnoe Khozyaĭstvo, No. 10, pp. 6-9. In Russian.

It is pointed out that the minimal age which is adopted by the investigator for biostatistical calculations must be one and the same for all generations which enter into the composition of the commercial stock.

13363. Engashev, V. G., and A. M. Muzykovskiĭ. 1970. THE USE OF MEDICINAL GRANULATED MIXED-FEED WITH PHENOSAL FOR INTESTINAL CESTODE INFESTATIONS IN THE CARP. (Ispol'zovanie lechebnogo granulirovannogo kombikorma s fenosalom pri kishechnykh tsestodozakh karpa). Rybnoe Khozyaĭstvo, No. 10, pp. 15-19. In Russian.

Because of the simple methodology of dehelminthization, the high efficacy of the medicinal granulated mixed feed with phenosal, and its harmlessness for fish, the method described can be employed widely in fish culture for control of bothriocephalesis and caviosis in conjunction with other veterinary-sanitary measures.

13364. Abelson, Philip H. (Editorial Office, Science, Washington, D. C.). 1970. METHYL MERCURY. Science 169, No. 3942, 237, July 17, 1970; Comm. Fish. Abstr., 23(11): p. 22.

This article discusses the pollution problem related to the production and use of mercury compounds. It also briefly describes some of the steps in the accumulation of methyl mercury in fishes [Jensen, S., and A. Jernelov, "Biological Methylation of Mercury in Aquatic Organisms," Nature 223, 753 (1969)]. Industrial wastes containing inorganic mercury compounds or phenyl mercury may find their way into the bottom muds of lakes. These compounds are converted into CH_3Hg^+ or $(CH_3)_2Hg$ by anaerobic organisms. $(CH_3)_2Hg$ is volatile and passes into the water column from the sediment. It is converted to Ch_3Hg^+ at low pH. The ion is soluble in water and is concentrated by living organisms of the lakes, usually appearing in the body lipids of the animals. The concentration in the fishes may, in part, come by way of the food chain, but apparently fishes may accumulate the ion directly. The concentration factor from water to pike fish is in the order of 3,000 or higher.

13365. Bates, Daniel W. (Bur. of Comm. Fish. Biol. Lab., Seattle, Washington). 1970. DIVERSION AND COLLECTION OF JUVENILE FISH WITH TRAVELING SCREENS. U. S. Fish and Wildl. Serv. Fish. Leaflet 633, 6 pp. (March 1970); Comm. Fish. Abstr., 23(11): p. 20.

A horizontal traveling screen, suitable for screening fish or debris from power plant water intakes or irrigation diversions, was designed and operated by the Bureau of Commercial Fisheries during 1965-69. The structure consisted of a vertically hung, endless belt of wire-cloth screen panels, flush with the face of the water intake structure or at an angle to the direction of flow. Field tests in different water approach velocities, with the screen traveling at various rates, proved that such a facility can be operated efficiently. The horizontal traveling screen, as described here, should contribute materially to the development of an efficient, relatively low-cost diversion facility for fish and debris. (Auth.)

13366. Finley, Mack T., Denzel E. Ferguson, and J. Larry Ludke (Dept. of Zool., Mississippi State Univ., State Coll., Mississippi). 1970. POSSIBLE SELECTIVE MECHANISMS IN THE DEVELOPMENT OF INSECTICIDE-RESISTANT FISH. Chemical Abstracts 73, No. 1, 2961v (July, 1970); Comm. Fish. Abstr., 23(11): p. 22.

13367. Parisot, Thomas J. (Western Fish Disease Lab., Sand Point Naval Air Sta., Seattle, Washington). 1970. SACRAMENTO RIVER CHINOOK DISEASE (SRCD). U. S. Dept. of Interior, Bur. Sport Fish. and Wildl., FDL-30, 2 p. (Slightly revised version of Fishery Leaflet 562 of October 1963).

Includes: Identification, Cause of the disease, Source and reservoir of infection, Mode of transmission, Incubation period, Period of communicability, Susceptibility and resistance, Geographic distribution, Methods of control, Annotated bibliography.

13368. Mullison, W. R. (Agric. Dept., The Dow Chemical Co., Midland, Michigan). 1970. EFFECTS OF HERBICIDES ON WATER AND ITS INHABITANTS. Weed Science, 18(6): 738-750.

There is little evidence that herbicides from agronomic or industrial usage are reaching or accumulating in our water supplies in amounts to cause a pollution problem. Fish tolerance to weed killers varies with their size and species as well as with differences in the aquatic site. There may be variation to different forms of the active ingredient. Other components in a formulation may be more toxic than the herbicide itself. Therefore, the LD_{50} of different formulations should be determined. In addition, the manner and other circumstances involving application of a herbicide may change its toxicity to water inhabitants. Our current knowledge of the effects of herbicides on fish, plankton, and other water inhabitants indicate that harmful effects with our present herbicides, when such exist, are only temporary. Available evidence suggests there is no biological magnification problem with herbicides. (Auth.)

13369. Owen, I. L. (Dept. of Zool., Univ. College of Wales, Aberystwyth, England). 1970. THE ONCOMIRACIDIUM OF THE MONOGENEAN Discocotyle sagittata. Parasitology, 61(2): 279-292.

A description is given of the morphology and behaviour of the oncomiracidium of the monogenean D. sagittata. The larva has many features in common with the oncomiracidium of Diplozoon paradoxum but its development is less precocious than the latter. Suggestions are made as to the possible relationships of a pair of degenerate hooks on the haptor. (Auth. summ.)

13370. Reed, Barry L., and Barrie C. Finnin (Victorian College of Pharmacy, Parkville, Victoria, Australia). 1970. A REFLECTANCE METHOD FOR THE CONTINUOUS MEASUREMENT OF MELANOPHORE RESPONSES IN LIVING FISHES. Life Sciences, Part II, Biochemistry, General and Molecular Biol., 9(17): 967-974.

A technique for the measurement and continuous recording of melanophore responses in living fishes has been described. Melanophore responses are detected by the photoelectric measurement of changes in the intensity of light reflected from the skins of immobilized spinal-sectioned fishes. The technique enables melanophore responses elicited by drugs and/or nerve stimulation to be measured accurately and recorded under suitably standardized conditions. (Authors summ.)

13371. Murphy, Philip G. (Hopkins Mar. Sta., Stanford Univ., Pacific Grove, California). 1970. EFFECTS OF SALINITY ON UPTAKE OF DDT, DDE AND DDD BY FISH. Bull. Environmental Contamination and Toxicology, 5(5): 404-407.

It is shown that salinity of 15 parts per thousand reduced the amount of DDT, DDE and DDD accumulated by experimental mosquitofish, and that salinity had a greater effect on the uptake of DDT than on the uptake of DDE or DDD.

13372. Solon, J. M., and J. H. Nair III (Syracuse Univ. Res. Corp., Life Sci. Div., Syracuse, New York). 1970. THE EFFECT OF A SUBLETHAL CONCENTRATION OF LAS ON THE ACUTE TOXICITY OF VARIOUS PHOSPHATE PESTICIDES TO THE FATHEAD MINNOW (Pimephales promelas Rafinesque). Bull. Environmental Contamination and Toxicology, 5(5): 408-413.

Four phosphorothionate insecticides were tested against fathead minnows - parathion, methyl parathion, ronnel and dicapthon; the 48 and 96 hour TLm values are given. The difference between the 48 and 96 hour TLm values of parathion exposures in the presence and absence of LAS are 32 and 49% respectively. Since a sublethal concentration of LAS was used, we have accepted any realistic decrease

in the TLm value as indicating synergism. Similar decreases in the TLm values for methyl parathion and ronnel were noted. No synergism was noted for dicapthon. Thus, the toxicity of the majority of phosphorothionate compounds tested is enhanced in the presence of LAS. Dicapthon, a metachloro substituted methyl parathion, is an exception, although the absolute TLm is about 5 fold greater than with the parent methyl parathion. The results of tests with guthion and trithion - both of the phosphordithioate structure -- show no change in guthion toxicity when LAS was present. Trithion showed a 40% increase in toxicity over 96 hours in the presence of LAS. In tests with two phosphorothionate compounds, EPN and trichloronat, the former shows no apparent synergism with LAS whereas trichloronat toxicity was found to be synergistically enhanced in the presence of LAS.

13373. Hatfield, C. T., and L. G. Riche (Dept. of Fish. and Forestry, St. John's, Newfoundland, Canada). 1970. EFFECTS OF AERIAL SUMITHION® SPRAYING ON JUVENILE ATLANTIC SALMON (Salmo salar L.) AND BROOK TROUT (Salvelinus fontinalis Mitchill) IN NEWFOUNDLAND. Bull. Environmental Contamination and Toxicology, 5(5): 440-442.

Forest sprays of the organophosphate pesticide, Sumithion, at 2 or 3 oz/acre were less acutely harmful to fish than sprays of the chlorinated hydrocarbon pesticide DDT have been in the past. Possible indirect or chronic effects cannot be discounted. (Authors conclusions)

13374. Alexander, R. McN. (Dept. of Zool., Univ. of Leeds, England). 1970. MECHANICS OF THE FEEDING ACTION OF VARIOUS TELEOST FISHES. Journal of Zoology, 162(2): 145-156.

Pressure changes have been recorded from the buccal cavities of nine species of teleost as they sucked food into their mouths. Some of the pressures recorded are discussed in relation to the sizes of the muscles responsible. Cinematograph films have been used to estimate how much the volume of the orobranchial chamber increases as food is sucked in. Some peculiarities in the feeding movements of Taurulus, Ictalurus and Anguilla are described and discussed. (Auth.)

13375. Finnin, B. C., and B. L. Reed (Victorian College of Pharmacy, Parkville, Victoria, Australia). 1970. THE CONTINUOUS RECORDING OF MELANOPHORE RESPONSES IN TELEOST FISHES. Life Sciences, Part II, Biochemistry, General and Molecular Biol., 9(6): 321-333.

A photoelectric method for the continuous recording of rapid melanophore responses in living spinal-sectioned fishes has been described. The method has advantages over other methods of color change measurement and allows the effects of drugs and nerve stimulation to be conveniently studied. (Authors summ.)

13376. Rehwoldt, Robert, and Gerald Bida (Dept. of Chem., Marist College, Poughkeepsie, New York). 1970. FISH AVOIDANCE REACTIONS. Bull. Environmental Contamination and Toxicology, 5(3): 205-206.

This is a description of research currently being carried out at Marist College. It is only part of a continuing and extensive effort to attempt to evaluate the effects of water quality upon fish population. (Authors)

13377. Van Vliet, W. H., and S. U. Qadri (Dept. of Biol., Univ. of Ottawa, Ottawa, Canada). 1970. CAPTURE, MORPHOLOGY AND FOOD OF LAKE CHARR ALEVINS IN LAKE HENEY, QUEBEC. Canad. Fld Nat., 84(2): 177-179.

In July, 1968, eight lake charr (Cristivomer namaycush) alevins were collected by otter trawl net at depths of 60-110 ft from Lake Heney, Gatineau County, Quebec, providing the first record of the capture of lake charr alevins (40.8-48.6 mm total length) from the wild populations in southwestern Quebec and southeastern Ontario. Morphologically they were similar to a hatchery raised sample of lake charr alevins. Mysis relicta and Pontoporeia affinis were found in their stomachs. (Authors)

13378. Mayer, F. L., Jr., J. C. Street, and J. M. Neuhold (An. Sci. Dept. and Ecol. Center, Utah State Univ., Logan, Utah). 1970. ORGANOCHLORINE INSECTICIDE INTERACTIONS AFFECTING RESIDUE STORAGE IN RAINBOW TROUT. Bull. Environmental Contamination and Toxicology, 5(4): 300-310.

Three dose levels each of dieldrin (0 mg, 0.04 mg, 0.2 mg), DDT (0 mg, 0.2 mg, 1.0 mg), and methoxychlor (0 mg, 0.6 mg, 3.0 mg) were used in a 3^3 completely randomized factorial design. All 27 possible compound and dose combinations were used in the study. Six fish were used per treatment. The fish were individually given doses of insecticides per os in corn oil enclosed in gelatin capsules. The fish were dosed on alternate days, seven doses in all. On the fifteenth day, the fish were killed and the body fat analyzed for lipid content and residual insecticides. Tissue storage of DDT and DDE increased when DDT and dieldrin were fed in combination. The same response had been noted in rats but was of much greater magnitude in fish. Dieldrin storage was reduced by the presence of either DDT or methoxychlor. The effect of methoxychlor was more pronounced than that of DDT. The effect of DDT on tissue dieldrin reduction is much less in fish than in rats. Feeding of DDT with methoxychlor resulted in decreased methoxychlor storage. The influence of dieldrin on increasing tissue methoxychlor was highly significant ($P < .01$) when fish were given doses of 3.0 mg methoxychlor. Insecticide interactions occur in fish, but large differences in these responses exist between fish and rats. (Authors summ.)

13379. McErlean, Andrew J., and Joseph A. Mihursky (Univ. of Maryland Nat. Res. Inst., Hallowing Point Sta., Prince Frederick, Maryland). 1968. SPECIES DIVERSITY SPECIES ABUNDANCE OF FISH POPULATIONS: AN EXAMINATION OF VARIOUS METHODS. Proc. of Southeast. Assoc. of Game and Fish Commissioners, 21st Ann. Conf., pp. 367-372.

Twenty sets of fish collection data were used to compare seven diversity indices. The data sets were chosen to represent the wide variation in habitat, ecologic condition, salinity, as well as other factors, encountered in fishery work. Cross comparisons of several index rankings were made and the dependencies of the various indices discussed. Variation of index score with number of species and with sample size was examined. Results indicate four indices may be applied to fishery work. (Authors)

13380. Reed, Paul H. (Fish Comm. of Oregon, Res. Div., Newport, Oregon). 1969. CULTURE METHODS AND EFFECTS OF TEMPERATURE AND SALINITY ON SURVIVAL AND GROWTH OF DUNGENESS CRAB (Cancer magister) LARVAE IN THE LABORATORY. J. Fish. Res. Bd. Canada, 26(2): 389-397.

Recent interest in causes of Dungeness crab (Cancer magister) population fluctuations led to a study of temperature and salinity effects on survival and growth of zoeae. Preliminary work developed methods for culturing larvae in flasks with good survival. A comparison of survival of larvae fed two different diets showed the nauplii of the barnacle Balanus glandula and larvae of the bay mussel Mytilus edulis were suitable and unsuitable food organisms, respectively. The optimum ranges of temperature and salinity for laboratory-cultured C. magister zoeae were 10.0-13.9 C and 25-30%, respectively. Zoeal survival was not significantly affected by temperatures and salinities approximating ocean ranges of these variables off the Oregon coast during the larval period. The growth rate of C. magister zoeae was directly related to temperature, but salinities that favored survival did not appear to affect the zoeal growth rate. (Auth.)

13381. Bauer, O. N. 1964. PARASITES AND DISEASES OF FISH AND PROPHYLACTIC MEASURES IN THE ESTABLISHMENT OF NEW SPECIES OF FISH IN WATERS. (Parazity i bolezni ryb i mery profilaktiki pri vselenii novykh vidov ryb v vodoemy). Izvestiya Gosudarstvennogo Nauchno-Issledovatel'skogo Instituta, Ozernogo i Rechnogo Rybnogo Khozyaĭstva, Vol. 57, 295-300. Translation from the Russian by Robert M. Howland, Bur. Sport Fisheries and Wildlife, Narragansett, Rhode Island.

The damage which diseases bring to commercial fish stocks is characterized on a number of examples. Agents and methods for controlling these afflictions are discussed. -- Robert M. Howland.

13382. Wingfield, William H., Linda Nims, J. L. Fryer and K. S. Pilcher (Dept. of Microbiol., Oregon State Univ., Corvallis, Oregon). 1970. SPECIES SPECIFICITY OF THE SOCKEYE SALMON VIRUS (OREGON STRAIN) AND ITS CYTOPATHIC EFFECTS IN SALMONID CELL LINES. Reprint from: "A Symposium on Diseases of Fishes and Shellfishes", special publication No. 5, Amer. Fish. Soc., Washington, D. C.

When fingerlings were exposed to the sockeye salmon virus by the addition of the agent to water in a concentration of $10^{3.7}$ $TCID_{50}$ per ml at 16 C, 17 of 20 sockeye salmon developed a fatal infection within 10 days, while 1 of 20 unexposed control fish succumbed. One of 20 chinook salmon exposed to the virus, and 2 of 20 unexposed controls died. Three of 20 exposed rainbow trout died, while all 20 controls survived. In the case of coho salmon 20 exposed fingerlings and 20 controls remained well. Thus the sockeye salmon only were found to be highly susceptible to the virus under these conditions. Histopathological examination of these fish revealed widespread destruction of the hematopoietic cells of the kidney. An established cell line from steelhead trout and a sockeye salmon cell line proved equally susceptible to the virus. In both cases the same characteristic cytopathic effect was produced in the first and all subsequent inoculated cultures. The concentration of infectious virus increased from about $10^{2.6}$ $TCID_{50}$ per 0.5 ml of culture fluid to $10^{6.4}$ $TCID_{50}$ per 0.5 ml in sockeye cell cultures during 5 days incubation at 18 C. In the steelhead cultures the comparable titer was $10^{6.0}$ $TCID_{50}$ per 0.5 ml. The virus was carried through a series of 5 subcultures in each cell line and could have been propagated indefinitely. The final concentration found in the 5th subcultures were not significantly higher than in the first. In an established line of chinook salmon cells no cytopathic effect was seen in the first series of inoculated cultures, and the virus concentration increased from about $10^{2.6}$ to $10^{3.4}$ $TCID_{50}$ per 0.5 ml in 5 days at 18 C. After a series of 5 transfers in these cell cultures however, the concentration increased from $10^{2.6}$ to $10^{5.2}$ $TCID_{50}$ per 0.5 ml, and the characteristic cytopathic effect was again evident. Thus a significant degree of adaptation was demonstrated. The typical changes produced in all infected cells by the virus included a distinct thickening of the nuclear membrane and alteration of the nucleoli. The latter showed a marked increase in optical density when observed in the living state by phase contrast microscopy, whereas in cells stained by the May-Grunwald Giemsa method they could no longer be visualized. (Authors)

13383. Koto, Tsutomu (Far Seas Fish. Res. Lab., Shimizu 424, Japan). 1969. STUDIES ON THE ALBACORE. X IV. DISTRIBUTION AND MOVEMENT OF THE ALBACORE IN THE INDIAN AND THE ATLANTIC OCEANS BASED ON THE CATCH STATISTICS OF JAPANESE TUNA LONG-LINE FISHERY. Bull. Far Seas Fisheries Research Laboratory, Shimizu, Japan, No. 1, pp. 115-129. In Japanese, with English summary.

The present report describes the distribution patterns and migratory movement of albacore Japanese tuna longliners are exploiting in the Indian and Atlantic Oceans, based upon the catch and effort statistics of the years 1961 through 1965 for both oceans, and the data of length composition in the catch from 1961 through 1965 for the Indian Ocean and from 1959 through 1966 for the Atlantic Ocean. (From Auth. summ.)

13384. Suda, Akira (Far Seas Fish. Res. Lab., Shimizu 424, Japan). 1970. APPROXIMATE ESTIMATION OF PARAMETERS IN DYNAMICS OF FISH POPULATION UTILIZING EFFORT AND CATCH STATISTICS WITH LITTLE INFORMATIONS ON BIOLOGICAL FEATURES. Bull. Far Seas Fisheries Research Laboratory, Shimizu, Japan, No. 3, pp. 1-14. In Japanese with detailed English synopsis.

A method is presented for evaluation of fish population parameters based upon catch and effort data with some supplementary biological information.

13385. Holland, Hugh T., and David L. Coppage (U. S. Fish and Wildl. Serv., BCF Center for Estuarine and Menhaden Res., Pesticide Fld. Sta., Gulf Breeze, Florida). 1970. SENSITIVITY TO PESTICIDES IN THREE GENERATIONS OF SHEEPSHEAD MINNOWS. Bull. Environ. Contamination and Toxicology, 5(4): 362-367.

13386. Nakagawa, Heisuke (Dept. of Fish., Fac. of Fish. and Animal Husb., Hiroshima Univ., Fukuyama, Japan). 1970. STUDIES ON RAINBOW TROUT EGG (Salmo gairdnerii irideus) II. CARBOHYDRATE IN THE EGG PROTEIN. J. Fac. Fish. Hiroshima, 9(1): 57-63. In English.

Component I which is a lipoprotein isolated from immature egg of rainbow trout contained hexose, hexosamine, and sialic acid as the carbohydrate constituent, Mannose predominated over galactose and glucose. The carbohydrate content of component I was lower than that of lipovitellin of hen's egg. Component II contained both hexose and pentose. It is suggested that the substance is a kind of glycoprotein similar to livetin of hen's egg yolk. The method for simultaneous determination of hexose and pentose was discussed. (Auth. summ.)

13387. Ueyanagi, Shoji, Shoji Kikawa, Masami Uto, and Yasuo Nishikawa (Far Seas Fish. Res. Lab., Shimizu, Japan). 1970. DISTRIBUTION, SPAWNING, AND RELATIVE ABUNDANCE OF BILLFISHES IN THE ATLANTIC OCEAN. Bull. Far Seas Fisheries Research Laboratory, No. 3, pp. 15-56. In Japanese with detailed English synopsis.

Data on distribution, spawning and relative abundance are given for swordfish, sailfish, white marlin, and blue marlin in the Atlantic Ocean.

13388. Suda, Akira (Far Seas Fish. Res. Lab., Shimizu, Japan). 1970. METHODS OF DEALING WITH SUSTAINABLE YIELDS FOR FISH SPECIES WITH MARKED DIFFERENTIATIONS OF LIVING PATTERN ON A COURSE OF LIFE HISTORY - I. BASIC CONSIDERATIONS ON THE CONDITIONS TO REALIZE A SUSTAINABLE YIELD AND APPLICATIONS OF TECHNIQUES TO CALCULATE AMOUNTS OF SUSTAINABLE YIELD FROM FISH POPULATIONS WHICH ARE EXPLOITED IN SIMPLE WAYS. Bull. Far Seas Fisheries Research Laboratory, No. 3, pp. 115-146. In Japanese with detailed English synopsis.

The Pacific bigeye tuna (Thunnus obesus) and albacore (Thunnus alalunga) are fish species of long life span and consequently each stock comprises numerous age groups. At the same time, patterns of distribution are remarkably differentiated by age, sex and spawning activity. Maturation and recruitment to fishable stocks need enough time to be completed. For such fish species, exploitation by fisheries may bring manifold biometric changes to a population when it occurs in various parts of a stock. As a result, a reproductive potentiality of population, average age of catch and amount of sustainable yield will undergo complicated changes in many phases. To make a proper evaluation of effects caused by fisheries on such a fish population, mathematical descriptions with adequate contemplations on biological characteristics are necessary. Though complex models need huge mathematical works involved, recent developments in electronics enable us to drill them. In the present paper, the author tried: 1) formation of models to handle fisheries dynamics of such a fish species, especially considering a condition to realize sustainable reproduction; 2) under some suppositions, practices of adoption of techniques developed here to some examples. (From Auth. summ.)

13389. Hayasi, Sigeiti, Tsutomu Koto, Chiomi Shingu, Susumu Kume, and Yasuo Morita (Far Seas Fish. Res. Lab., Shimizu, Japan). 1970. STATUS OF TUNA FISHERIES RESOURCES IN THE ATLANTIC OCEAN, 1956-1967. Resources and Fisheries of Tunas and Related Fishes in the Atlantic Ocean - Far Seas Fisheries Research Laboratory, S Series 3, pp. 1-72. In English.

The status of the resources of yellowfin tuna, albacore, bigeye tuna, bluefin tuna, southern bluefin tuna, skipjack, and marlins and related species in the Atlantic Ocean is given for 1956-1967. Details are given on: distribution and migration; growth and maturation; amount and length composition of catch; stock assessment.

13390. Zitko, V. (Fish. Res. Bd. Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1970. POLYCHLORINATED BIPHENYLS (PCB) SOLUBILIZED IN WATER BY NONIONIC SURFACTANTS FOR STUDIES OF TOXICITY TO AQUATIC ANIMALS. Bull. Environmental Contamination and Toxicology, 5(3): 279-285.

13391. Anokhina, L. E. 1969. REGULARITIES OF CHANGE IN THE FECUNDITY OF FISH. ON THE EXAMPLE OF THE SPRING AND AUTUMN-SPAWNING SPRAT. (Zakonomernosti izmeneniya plodovitosti ryb na primere vesenne - I osenneneresti-yushcheĭ salaki). Akademiya Nauk SSSR, Institut Evolyutsionnoĭ morfologii i ekologii zhivotnykh Im. A. N. Severtsova, Publisher "NAUKA", Moscow, 291 p. In Russian.

This investigation represents part of a large series of works to be completed by one plan in the area of study of the regularities of fish population dynamics, begun by the Ichthyological Laboratory of the Institute of Morphology of Animals AS USSR and to be continued by the Laboratory of Ecology of Lower Vertebrates of the A. N. Severtsov Institute of Evolutionary Morphology and Ecology of Animals, Academy of Sciences of the USSR. (From foreword)

13392. Ahlbert, Inga-Britt. 1970. THE ORGANIZATION OF THE CONE CELLS IN THE RETINAE OF FOUR TELEOSTS WITH DIFFERENT FEEDING HABITS (Perca fluviatilis L., Lucioperca lucioperca L., Acerina cernua L. AND Coregonus albula L.). Arkiv for Zoologi, 22(11): 445-481.

The present investigation comprises a basic mapping of the variations in regard to cone types, density distribution of the cones and the cone mosaic in the retinae of four teleosts and an attempt to correlate these variations in different respects with the feeding habits of the fishes in question. The material consists of retinae from perch (Perca fluviatilis), pike-perch (Lucioperca lucioperca) and ruffe (Acerina cernua) belonging to the family Percidae and of cisco (Coregonus albula) belonging to the family Salmonidae. In perch, which is a piscivorous predator with a good perception of movement, the cone cells are arranged in a regular square pattern and in the temporal part of the retina there is an area-like region in the form of a wedge in from the ora serrata. The pike-perch, which is also a piscivorous predator, has a very different retinal organization. It has a cone mosaic varying between row pattern and square pattern, the row pattern predominating. No area-like region has been found. The variation in cone density in the fundus of the eye is small. The retina of the pike-perch seems to be constructed more for high sensitivity than for acute vision. The ruffe, which is bottom-dwelling and feeds mainly on bottom organisms, has a cone mosaic consisting partly of rows and partly of squares. There is a band with a somewhat higher cone density in the horizontal plane suggesting a more acute vision in this part of the eye. The highest values are found in the rostral part of the eye. The cisco feeds on zooplankton throughout its life and its retina seems to be adapted to catching plankton from below, as do certain plankton-feeding clupeids. The cone mosaic consists of square pattern and row pattern. The type of mosaic is correlated with the cone density in such a way that the temporal half of the retina with the highest cone density is provided with square mosaic and the rostral half, with a relatively low cone density, is provided with row mosaic. The highest cone density is found in an area-like region ventro-temporally in the retina. A characteristic of the retinae examined is an increase of the cone density towards the ora serrata. The results from perch, ruffe and cisco indicate that in each of these species the range of variation in the number of cones/unit area is greater in a small eye than in a large eye. In 5 mm and 8 mm stages of pike-perch only single cones have been found, while in 11 mm and 14 mm stages both single cones and double cones are present. These results suggest that the differentiation of double cones occurs between the 8 mm and the 11 mm stages. (Auth.)

13393. Mounib, M. S., and J. S. Eisan (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1968. URICOLYTIC ENZYMES IN COD SPERM. Canadian Journal of Physiology and Pharmacology, No. 46: 283-284; 1968 Studies, Part I, Fish. Res. Bd. Canada, FRB Studies No. 1231, pp. 413-414.

Cod sperm produced ^{14}C-uric acid when incubated in the presence of $^{14}CO_2$, suggesting a de novo biosynthesis of purine by fish sperm. Extracts of the acetone powder of cod sperm showed activities of uricase, allantoinase, and allantoicase. (Authors)

13394. Donaldson, E. M., and U. H. Fagerlund (Fish. Res. Bd. Canada, Vancouver, Canada). 1968. CHANGES, RESULTING FROM SEXUAL MATURATION, IN THE HALF LIFE (T 1/2) AND VOLUME OF DISTRIBUTION (V) OF RADIOACTIVITY AFTER INJECTION OF C^{14} CORTISOL (F) INTO SALMON. Exerpta Medica International Congress Series No. 157, Item No. 348, 1968; 1968 Studies, Part 2, Fish. Res. Bd. Canada, FRB Studies No. 1259, p. 213.

Maturing, mature, spawned and gonadectomized Oncorhynchus nerka were injected with 0.5 μc F. Blood samples were taken at 5, 10, 20, 40, 80, 120, 160, 260 and 320 min. Plasma was extracted with dichloromethane and the radioactivity (F + cortisone) determined by liquid scintillation counting. Radioactivity decreased rapidly up to 40 min. and then more slowly. T 1/2 and V were calculated on the basis of a two-compartment model. T 1/2 incraased from 1.5 to 2.2 to 3.0 hr. ($.05 < p < .1$) in maturing, mature, and spawned fish, respectively. V increased from 14.5 to 36.8 to 65.0% of BW ($p < 0.001$) in maturing, mature and spawned fish. T 1/2 was 2.0 and V was 14.8 in gonadectomized fish. Resting F. conc. was 2.9 and 8.5 μg/100 ml plasma in maturing and spawned fish ($p < .005$). The greater increase in V than in T 1/2 during maturation and spawning and the increased F conc. in the spawned fish, in this experiment, indicate that the rate of secretion of F probably increases during maturation and spawning and may be explained by the occurrence of hyperplastic interrenal tissue reported in this species. These results show that the clearance of corticosteroids is not significantly impaired after spawning.

13395. Li, M. F., and Carol Jordan (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1968. A PROTEOLYTIC PSEUDOMONAD FROM SKIN LESIONS OF RAINBOW TROUT (Salmo gairdnerii). II. SOME PROPERTIES OF THE PROTEINASE. Canadian Journal of Microbiology, 14(8): 875-880; 1968 Studies, Part 2, Fish. Res. Bd. Canada, FRB Studies No. 1258, pp. 207-212.

An extracellular proteinase from a pseudomonad pathogenic to rainbow trout was purified 33-fold by ammonium sulfate fractionation, DEAE-cellulose column chromatography, and Sephadex G75 gel filtration. The purified enzyme was active over a wide pH range, from pH 5.0 to 10.0. Heating at 98°C for 1 h did not completely inactivate the enzyme. Its observed temperature optimum was 45°C. Michaelis-Menten constants were found to be 0.625% for casein and 0.263% for rainbow trout muscle albumin. Activation energies calculated for these substrates were 8.1 kcal and 11.4 kcal per mole, respectively. The involvement of bivalent cations and free sulfhydryl groups in the enzymatic activity was demonstrated by the inhibition caused by metal-complexing agents and p-chloromercuribenzoate, respectively. (Authors)

13396. Yamazaki, Fumio, and Edward M. Donaldson (Fish. Res. Bd. Canada, Vancouver Lab., Vancouver, Brit. Columbia, Canada). 1968. THE SPERMIATION OF GOLDFISH (Carassius auratus) AS A BIOASSAY FOR SALMON (Oncorhynchus tshawytscha) GONADOTROPIN. General and Comparative Endocrinology, 10(3): 383-391; 1968 Studies, Part 2, Fish. Res. Bd. Canada, FRB Studies No. 1249, pp. 135-143.

Spermiation in the goldfish (Carassius auratus) is defined as the release of spermatozoa into the sperm duct by thinning of the semen. This phenomenon was completely inhibited by hypophysectomy. Intraperitoneal injection of 0.03 mg per 10 gm body weight of a salmon pituitary gonadotropic preparation caused spermiation in all mature male hypophysectomized goldfish. Human chorionic gonadotropin was also effective for spermiation. A linear relationship was observed between the logarithm of the dose of these two hormones and the spermiation response. Equine luteinizing hormone and ovine follicle stimulating hormone did not cause spermiation. No cytological change was seen in the seminiferous lobules at spermiation. However, changes were noted in the interstitial cells and also in the epithelial cells of the sperm duct. The use of the spermiation response in hypophysectomized male goldfish as a bioassay for salmon gonadotropin is discussed. (Authors)

13397. Brown, V. M., D. G. Shurben, and D. Shaw (Water Poll. Res. Lab., Stevenage, England). 1970. STUDIES ON WATER QUALITY AND THE ABSENCE OF FISH FROM SOME POLLUTED ENGLISH RIVERS. Water Research, 4(5): 363-382.

Field studies made to determine the acute, lethal toxicity of some polluted river waters and an estuary water to rainbow trout, brown trout, roach, and dace are described. The 48 hr median lethal concentrations, for rainbow trout, of clean-water dilutions of the polluted fresh waters were found to be about 65 percent of those predicted from the chemical qualities of the waters. Prediction seriously underestimated the toxicity of the saline waters. The application of the studies is discussed. (Authors)

13398. Eaton, John G. (Nat. Water Qual. Lab., Duluth, Minnesota). 1970. CHRONIC MALATHION TOXICITY TO THE BLUEGILL (Lepomis macrochirus Rafinesque). Water Research, 4(10): 673-684.

Bluegills were exposed to seven malathion concentrations in a diluter-regulated, flowing-water test system. Concentrations of 66 and 28 $\mu g\ l^{-1}$ were lethal to all fish within 16 and 54 days, respectively, and some were killed at 15 $\mu g\ l^{-1}$. The fish spawned under the test conditions and the toxicant's effect was observed on all life cycle stages. Reproduction and early fry survival were unaffected by the 7.4 $\mu g\ l^{-1}$ concentration that crippled adult fish after several months exposure. Experimentally determined safe (3.6 $\mu g\ l^{-1}$) and unsafe (7.4 $\mu g\ l^{-1}$) concentrations, between which must lie the "maximum acceptable toxicant concentration" (i.e. just barely safe concentration), were divided by a short-term toxicity value to obtain a pair of factors. This pair for bluegills (0.043 and 0.090) is compared to one (0.019 and 0.053) previously calculated for fathead minnows exposed to malathion. The similarity of the two pairs indicates that an "application factor", consisting of the maximum acceptable toxicant concentration divided by the short-term test value, for one species exposed to a toxicant might be useful in estimating long-term safe concentrations of this substance to other species from short-term test results only. This view is strengthened by the fact that the long-term toxicity of malathion to bluegills is more than 50 times that to the fathead minnow. (Auth.)

13399. Rudling, Lars (Swedish Water and Air Poll. Res. Lab., Stockholm, Sweden). 1970. DETERMINATION OF PENTACHLOROPHENOL IN ORGANIC TISSUES AND WATER. Water Research, 4(8): 533-537.

A method for the determination of pentachlorophenol (PCP) in tissues and natural waters is described. The PCP is extracted from the acidified sample with n-hexane and then re-extracted into a borax solution. It is then acetylated by extracting with n-hexane containing acetic acid anhydride and pyridine. The resulting pentachlorophenyl acetate is analysed by gas chromatography using an electron capture detector. The PCP content in fish from a lake into which PCP is discharged is reported. The data obtained indicate that PCP accumulates in aquatic organisms. The identity of the PCP was established by combined gas chromatographic-mass spectrometric analysis. (Auth.)

13400. Hughes, Robert A., Gilman D. Veith, and G. Fred Lee (Water Chem. Lab., Univ. of Wis., Madison, Wisconsin). 1970. GAS CHROMATOGRAPHIC ANALYSIS OF TOXAPHENE IN NATURAL WATERS, FISH AND LAKE SEDIMENTS. Water Research, 4(8): 547-558.

In the course of studying the fate of the chlorinated hydrocarbon pesticide, toxaphene, applied to several Wisconsin lakes for rough fish control, special clean-up procedures were developed for water, suspended solids, net plankton, fish and sediment. Column chromatography on Florisil, magnesium oxide, alumina and acid-Celite, either alone or in combinations was used to remove from sample extracts, substances which interfered with the electron capture gas chromatographic quantitation of toxaphene. The minimum detectable amount was 0.1 ng. The presence of toxaphene was verified by thin-layer chromatography. The types of interferences encountered and the procedures used to remove them are discussed in terms of ease of sample preparation and recovery efficiency. (Authors)

13401. Charlon, Nicole, B. Barbier, and L. Bonnet (Lab. d'Hydrobiologie, Centrale thermique E. D. F. B. P. 23, 77 - Montereau, France). 1970. THERMAL RESISTANCE OF RAINBOW TROUT Salmo gairdneri Richardson TO ABRUPT TEMPERATURE VARIATIONS. Annales d'Hydrobiologie, 1(1): 73-89.

An attempt to study the survival possibilities of Salmo gairdneri Richardson, after abrupt increases in temperature has been made through tests of thermal resistance directly derived from methods widely used in toxicology. Furthermore it has been possible to demonstrate that in the case of an artificial increase in temperature of 7°C due to thermal pollution of a thermal plant, the temperature of 14°C should be retained as the critical threshold value upstream of the thermal plant. The series of experiments performed support two main conclusions: - the prime importance of the acclimation period on the thermal resistance of the species; - the upper limit of acclimation above which no possibility of survival exists : 27°C. (Authors summ.)

13402. Billard, R., and P. de Kinkelin (Sta. centrale de Physiologie animale, Centre national de Recherches zootechniques, 78 - Jouy-en-Josas, France). 1970. STERILIZATION OF THE TESTICLES OF GUPPIES BY MEANS OF NON-LETHAL DOSES OF PARATHION. Annales d'Hydrobiologie, 1(1): 91-99.

Young immature guppies and adult males are treated in dilute parathion, at doses of 0.01-0.1-1 and 10 ppm. At the 10 ppm dose, fish die within a few hours, other concentrations do not cause a high mortality rate or alter spermatogenesis, if the exposure time is short (six days). On the contrary, if the fish remains in parathion over a prolonged period (40 days), there is a marked inhibition of spermatogenesis, expressed by a decrease in the number of germinal cells which is the greater, the higher is the dose of parathion. Results are similar to those obtained after hypophysectomy, which enables to suppose that parathion may play a role in the gonadotropic factors. These results confirm the necessity to define pesticide doses supportable in water, not using TLM but various criteria including gametogenesis. (Authors summ.)

13403. Heyl, Henry L. (Dept. of Anat., Dartmouth Med. School, Hanover, New Hampshire). 1970. CHANGES IN THE CORPUSCLE OF STANNIUS DURING THE SPAWNING JOURNEY OF ATLANTIC SALMON (Salmo salar). General and Comparative Endocrinology, 14(1): 43-52.

In an effort to clarify the function of the corpuscle of Stannius in Atlantic salmon (Salmo salar), histological studies were made of specimens from Canadian fish taken at various stages in the spawning journey. The general architecture and cell types of the corpuscle changed in several ways; these were more closely related to time in fresh water than to gonadal development. An anatomical unit composed of ganglion cells, nerves, and thick-walled blood vessels was consistently noted between the corpuscle and adjacent renal tissue. The relation of these observations to the overall function of the teleostean kidney with its several mechanisms for homeostatic control of electrolytes and steroid activity is briefly discussed. (Auth.)

13404. Fenwick, James C. (Dept. of Zool., Univ. of Brit. Columbia, British Columbia, Canada). 1970. DEMONSTRATION AND EFFECT OF MELATONIN IN FISH. General and Comparative Endocrinology, 14(1): 86-97.

Melatonin (N-acetyl-5-methoxytryptamine) was identified in the pineal organ of the Pacific salmon Oncorhynchus tshawytscha by thin-layer chromatography and detectable stores were found to be restricted to this organ. The store of melatonin was 6 times greater in immature salmon than in mature ones. Melatonin, produced or stored specifically within the pineal organ, appears to exert an inhibitory effect upon gonad functions, possibly by inhibiting the release of a gonadotropic factor.

13405. Lupo di Prisco, C., G. Materazzi, and G. Chieffi (Inst. of Zool. and Comp. Anat., Univ. of Camerino, Italy). 1970. IN VITRO STEROIDOGENESIS IN THE TESTICULAR TISSUE OF THE FRESH WATER TELEOST Esox lucius. General and Comparative Endocrinology, 14(3): 595-598.

13406. Lederis, K. (Dept. of Zool., Univ. of Calif., Berkeley, California). 1970. TELEOST UROPHYSIS. I. BIOASSAY OF AN ACTIVE UROPHYSIAL PRINCIPLE ON THE ISOLATED URINARY BLADDER OF THE RAINBOW TROUT, Salmo gairdneri. General and Comparative Endocrinology, 14(3): 417-426.

Estimations of the bladder-contracting substance in urophysial extracts of several teleost species showed that concentration of activity was considerably lower in salmonids (rainbow trout and chinook salmon) than in the mudsucker Gillichthys mirabilis, Tilapia mossambica, or the mullet Mugil cephalus.

13407. Bara, Gonül (Bingham Lab., Yale Univ., New Haven, Connecticut). 1970. HISTOCHEMICAL DEMONSTRATION OF 3β-, 3α-, 11β-, AND 17β-HYDROXY-STEROID DEHYDROGENASES IN THE TESTIS OF Fundulus heteroclitus. General and Comparative Endocrinology, 13(2): 189-200.

13408. Hafeez, M. A., and W. B. Quay (Dept. of Zool., Univ. of Calif., Berkeley, California). 1970. HISTOCHEMICAL AND EXPERIMENTAL STUDIES OF 5-HYDROXYTRYPTAMINE IN PINEAL ORGANS OF TELEOSTS (Salmo gairdneri AND Atherinopsis californiensis). General and Comparative Endocrinology, 13(2): 211-217.

Occurrence and localization of 5-hydroxytryptamine (5-HT) in pineals of rainbow trout (Salmo gairdneri) and jacksmelt (Atherinopsis californiensis) were investigated by means of the fluorescence histochemical procedure perfected by Hillarp and Falck. All fish were kept in a 14 hr/day photoperiod and were experimentally injected and autopsied either during the night or during the day. Although little if any 5-HT-specific fluorescence was seen in control (saline-injected) fish pineals, others injected with either or both 5-hydroxytryptophan (5-HTP) and iproniazid (a monoamine oxidase inhibitor) did show such fluorescence. Active uptake by the fish pineals of 5-HTP and synthesis of 5-HT appear likely. Differences in results according to time of treatment and autopsy were not detectable. (Authors)

13409. Overstreet, Robin M. (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1970. TWO NEW SPECIES OF DIGENEA FROM THE SPOT, Leiostomus xanthurus Lacépède, FROM THE GULF OF MEXICO. J. Parasit., 56(6): 1055-1057.

Two new species of Digenea are described from the euryhaline fish, Leiostomus xanthurus, from near Ocean Springs, Mississippi. The first, Apocreadium manteri, is most like A. uroproctoferum Sogandares-Bernal, 1959, from which it differs by having multispined scales and larger eggs and not possessing a uroproct. The second, Lecithaster leiostomi, is most like L. gibbosus (Rudolphi, 1802) from which it differs primarily by having a more elongated seminal vesicle and stockier vitelline lobes. Lecithaster musteli Srivastava, 1966, is considered a synonym of L. confusus Odhner, 1905. (Auth.)

13410. Overstreet, Robin M., and Charles E. Brown (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1970. Lasiotocus trachinoti sp. n. (DIGENEA: MONORCHIIDAE) FROM THE POMPANO, Trachinotus carolinus (Linnaeus), ALONG THE EAST COAST OF FLORIDA. J. Parasit., 56(5): 941-943.

The monorchiid trematode Lasiotocus trachinoti sp. n. is described from the intestine and pyloric caeca of young Trachinotus carolinus. It is most like L. mulli of Bartoli and Prevot, 1966, but differs from it primarily by being smaller and having cirrus spines more evenly dispersed. (Authors)

13411. Threlfall, William, and George Hanek (Dept. of Biol., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1970. HELMINTHS FROM NORTHERN PIKE (Esox lucius L.) IN LABRADOR. J. Parasit., 56(4): p. 662.

Helminths found in specimens of Esox lucius from Eagle River and Naskaupi River, Labrador: Tetraonchus monenteron; Bunodera luciopercae; Proteocephalus pinguis; Proteocephalus sp.; Raphidascaris sp.; Camallanus sp.; Acanthocephalus lateralis.

13412. Harris, J. E. (Dept. of Biol. Sci., Hatherly Labs., Exeter Univ., Exeter, Devon, England). 1970. PRECIPITIN PRODUCTION BY CHUB (Leuciscus cephalus) TO AN INTESTINAL HELMINTH. J. Parasit., 56(5): p. 1035.

This communication reports the ability of chub (Leuciscus cephalus) to produce precipitins to the acanthocephalan Pomphorhynchus laevis.

13413. Russell, Warren J., Edward W. Voss, Jr., and M. Michael Sigel (Dept. of Microbiol., Univ. of Miami School of Medicine, Miami, Florida). 1970. SOME CHARACTERISTICS OF ANTI-DINITROPHENYL ANTIBODY OF THE GRAY SNAPPER. J. Immunol., 105(1): 262-264.

Gray snappers were immunized with dinitrophenylated hemocyanin and purified antibodies to the haptenic determinant (2, 4-dinitrophenol) were obtained from two serum pools by immune absorption. Examination of these antibodies revealed a single high molecular weight protein with an apparent valence of 5 and a relatively low binding constant. (Authors summ.)

13414. Kuhns, William J., Joseph V. Chuba, and Ross F. Nigrelli (Immunohematology Lab., Bellevue Hosp. Center, New York, New York). 1970. THE ANTIGENIC SPECIFICITY OF BLOOD GROUPS WHICH DIFFERENTIATE POPULATIONS OF FRESH WATER CATFISH. J. Immunol., 105(2): 299-305.

Erythrocytes derived from fresh water catfish, Ictalurus nebulosus (Le Sueur) and Ictalurus catus (Linnaeus), referred to as groups I and II, were capable of eliciting specific immune responses as demonstrated by cross-immunization, stimulation of goats and rabbits, and absorption studies of immune antisera. Two forms of immune response were elicited in goats and rabbits, one against an antigen common to erythrocytes from individuals of groups I and II, and the other against a Forssman-like antigenic substance present on group I, but not group II, erythrocytes. The presence of two classes of immunoglobulins formed during immune responses was suggested on the basis of differences in sensitivity of agglutinins to mercaptoethanol before and after antigenic stimulation. Members of group I possessed a soluble blood group substance in serum and mucus, as demonstrated by agglutination-inhibition tests in the presence of human anti-A antiserum, lima bean lectin, and hemagglutinins in serum from group II individuals. (Authors)

13415. Hayashida, Ted, and Michael D. Lagios (Dept. of Anatomy and Dept. of Pathol., Univ. of Calif., San Francisco Med. Center, San Francisco, California). 1969. FISH GROWTH HORMONE: A BIOLOGICAL IMMUNOCHEMICAL, AND ULTRASTRUCTURAL STUDY OF STURGEON AND PADDLEFISH PITUITARIES. General and Comparative Endocrinology, 13(3): 403-411.

In contrast to pituitary growth hormone (GH) of modern bony fish (teleosts), the hormone in pituitary extracts of two primitive bony fish (chondrosteans) - the Pacific white sturgeon and the paddle fish - stimulated growth of the hypophysectomized rat as demonstrated by the tibia assay and immunochemically cross-reacted with monkey antiserum to rat GH, as shown by radioimmunoassay. In addition, electron microscopic studies revealed that these primitive fish, unlike the teleosts, possess a median eminence, with morphological features similar to those of tetrapods. (Authors)

13416. Wilson, Nadine, and Michael Smith (Dept. of Biochem., Fac. of Med., Univ. of Brit. Columbia, Vancouver, Brit. Columbia, Canada). 1969. ISOLATION AND AMINO ACID SEQUENCE OF NEUROHYPOPHYSEAL HORMONES OF PACIFIC CHINOOK SALMON (Oncorhynchus tschawytscha). General and Comparative Endocrinology, 13(3): 412-424.

Improved methods have been developed for extraction, fractionation according to molecular size, and cation-exchange fractionation of neurohypophyseal hormones. These have been applied to the isolation of 4-serine, 8-isoleucine oxytocin, and 8-arginine oxytocin from neurohypophyses of Oncorhynchus tschawytscha. The hormones were characterized by amino acid analysis and by determination of their amino acid sequences after performic acid oxidation. (Authors)

13417. Lawrence, James L. (Dept. of Biol., Hartwick College, Oneonta, New York). 1970. EFFECTS OF SEASON, HOST AGE, AND SEX ON ENDOHELMINTHS OF Catostomus commersoni. J. Parasit., 56(3): 567-571.

Two hundred seventy-nine white suckers (Catostomus commersoni) were collected from June 1966 through May 1968 from Pushaw Lake, Penobscot County, Maine. Data were collected on 3 caryophyllaeid cestodes (Glaridacris laruei, G. catostomi, and Isoglaridacris bulbocirrus), 1 digenetic trematode (Triganodistomum attenuatum), and 1 ancanthocephalan (Pomphorhynchus bulbocolli). The data were analyzed using a 2-factor ANOVA, Duncan's Multiple Range Test, and where applicable, correlation coefficients. Effects of season, host age, and sex on parasite burden were noted. Host sex was found to have only slight significance (P 0.10) on three species (G. laruei, P. bulbocolli, and T. attenuatum). No effect was noted for the other species. Infection was found to increase with increased host age for both G. catostomi (P 0.05) and I. bulbocirrus (P 0.025). Infections of I. attenuatum tended to decrease with increased host age (P 0.01). No age effects were noted for the other species. Marked seasonal effects were noted for G. catostomi, G. laruei, and I. bulbocirrus (P 0.005), all three being most abundant during the period January to April. T. attenuatum and P. bulbocolli were most abundant in the summer (P 0.005 and 0.05, respectively). (Auth.)

13418. Tidd, Wilbur M. (Fac. of Zool., Ohio State Univ., Columbus, Ohio). 1970. EXPERIMENTAL TRANSFER OF LARVAE OF Lernaea cyprinacea L. FROM GOLDFISH TO THE LEOPARD FROG. J. Parasit., 56(3): 572-574.

Fifth copepodid larvae of Lernaea cyprinacea were experimentally transferred from goldfish to newly metamorphosed frogs, Rana pipiens. The percentage of infestation was low compared to control fishes and tadpoles. Penetration of tadpoles by 5th-copepodid larvae followed by metamorphosis of both was a second method of frog infestation observed. Natural infestation of frogs was recorded. (Auth.)

13419. Risebrough, R. W. (Inst. of Marine Resources, Calif. Univ., Berkeley, California). 1969. CHLORINATED HYDROCARBONS IN MARINE ECOSYSTEMS. In: Chemical Fallout-Current Research on Persistent Pesticides, Proc. Publication of Rochester Univ., Conf. on Toxicity; Selected Water Resources Abstracts, 3(23): p. 35.

Polychlorinated biphenyls, chlorinated hydrocarbons which are extensively used in industry and agriculture, are now widely distributed in marine ecosystems of the Pacific Ocean. Birds contain higher concentrations of these chemicals than fish; tissues of the peregrine falcon have contained the highest amounts which have so far been recorded. The polychlorinated biphenyls have not been detected in samples of airborne particulates but their observed distribution in the sea indicates that they are dispersed by wind currents and that their fallout pattern is similar to that of the DDT compounds. Their effects upon natural populations, including man, are as yet unknown. Among the chlorinated hydrocarbon 'pesticides', DDE is accumulating in significant amounts in marine food chains, and is also present in highest concentrations in marine-birds, especially the procellariform species. Its distribution indicates that coastal areas are not the primary sources of contamination. Wind transport can account for the observed distribution of DDT compounds in California waters.

13420. Klein, David H., and Edward K. Goldberg (Scripps Inst. of Oceanog., La Jolla, California). 1970. MERCURY IN THE MARINE ENVIRONMENT. Environmental Science and Technology, 4(9): 765-768; Selected Water Resources Abstracts, 3(23): p. 35.

Mercury levels in marine sediment and three marine organisms - crab, whelk, and rock scallop - are 500 times or more greater than those in seawater of the California coastal environment of La Jolla and Palos Verdes. The subject of mass poisoning in aquatic life of recent note, mercury is released to the environment at an estimated rate of 4000-5000 tons annually. Higher values of mercury are found in sediments near sewer outfalls as compared to similar deposits further removed. The dispersion of this toxic pollutant by marine organisms and by man has already had serious consequences.

13421. Butler, P. A. (Bur. of Comm. Fish., Gulf Breeze, Florida). 1969. THE SIGNIFICANCE OF DDT RESIDUES IN ESTUARINE FAUNA. In: Chemical Fallout-Current Research on Persistent Pesticides, Proc. Publication of Rochester Univ. Conf. on Toxicity; Selected Water Resources Abstracts, 3(23): p. 35.

A nationwide program was initiated in 1965 to monitor residues of ten synthetic, chlorinated hydrocarbon pesticides in estuarine populations of fish and shellfish. About 160 stations have been established where samples are collected at thirty-day intervals for analysis by gas chromatography with electron capture. The summarized data show that estuarine pollution levels reflect the intensity of agriculture in the associated river basin. Experiments were undertaken to determine effects of a DDT-contaminated diet on fish and crustaceans. There was essentially no correlation between the amount of DDT residue and the size of the animal or the length of time it fed on the contaminated food. The experimental and monitoring data indicate that existing widespread pesticide pollution is causing significant decreases in productivity of estuarine populations of fish and shellfish. Resistant surviving animals are instrumental in concentrating and transmitting lethal amounts of pesticide residues in the food web.

13422. Jernelov, A. (Inst. for Vatten och Euftvardforskning, Stockholm, Sweden). 1969. CONVERSION OF MERCURY COMPOUNDS. In: Chemical Fallout-Current Research on Persistent Pesticides, Proc. Publication of Rochester Univ. Conf. on Toxicity; Selected Water Resources Abstracts, 3(23): p. 38.

It is shown in Sweden that fish contain methylmercury in instances where the original discharge contains other types of mercury compounds. Mercury discharge in the form of metallic mercury, inorganic divalent mercury, phenylmercury and alkoxi-alkylmercury can all be converted in nature to methylmercury.

13423. Johnels, A. G., and T. Westermark (Naturhistoriska Riksmuseet, Stockholm, Sweden). 1969. MERCURY CONTAMINATION OF THE ENVIRONMENT IN SWEDEN. In: Chemical Fallout-Current Research on Persistent Pesticides, Proc. Publication of Rochester Univ. Conf. on Toxicity; Selected Water Resources Abstracts, 3(23): p. 40.

Mercury and mercury compounds have a wide use in agriculture and industry, and an increase in natural levels of mercury content has been recorded. By means of activation analysis, the mercury content in feathers of eleven Swedish terrestrial bird species was studied. The material was derived from museum collections and from living or freshly killed birds; it covers a period of more than 100 years. These studies reveal nearly constant mercury levels from the middle of the previous century until 1940. After that, a well-documented increase in mercury concentration occurs, amounting to at least ten to twenty times the previous level. In 1940 alkylmercury compounds began to be used as seed dressings. The mercury content in axial musculature of pike (Esox lucius) has been used for estimating the level of mercury in the aquatic environment. Two fish-eating bird species show a gradual increase in mercury content since the previous century.

13424. Campbell, Robert S., Arthur Witt, Jr., and James R. Whitley (Missouri Univ., Dept. of Zool., Columbia, Missouri). 1970. POSSIBILITIES FOR BENEFICIAL USES OF HEATED WATER DISCHARGES INTO COOLING RESERVOIRS. Fifth Ann. Wat. Res. Research Conf., Feb. 3-4, 1970, Washington, D. C.; U. S. Dept. of Interior, Office of Wat. Res. Research, June 1970, pp. 57-64; Selected Water Resources Abstracts, 3(23): p. 41.

Montrose Lake and Thomas Lake in Missouri were studied. Both were artificial cooling reservoirs. Studies included water quality, primary production of algae, plankton and bottom fauna and fish. Impact of heated water upon the ecology of a reservoir will be lessened as the volume of the reservoir is increased. Employment of a long cooling canal results in loss of heat to the atmosphere prior to discharge into the reservoir. Under the conditions existing in Thomas Hill Reservoir, no lethal effects from heated water inflow was observed. Beneficial effects which may be derived from controlled discharge of heated water are: (a) Migration of fishes may result in a buildup of fish densities. (b) The increased density of

fishes may provide an extended harvest into the winter period. (c) Continued growth of game fishes may occur during the winter period. (d) An increased production of commercially raised fish may be possible. (e) The location of the power plant might be planned to provide optimal conditions for fish harvest and for use of heated water effluent in hatchery and rearing pools.

13425. Merriman, Daniel (Conn. Yankee Atomic Power Co., Haddam, Connecticut). 1970. DOES INDUSTRIAL COLEFACTION JEOPARDIZE THE ECOSYSTEM OF A LONG TIDAL RIVER. Symposium on Environmental Aspects of Nuclear Power Stations, N. Y., Aug. 12, 1970. Paper IAEA-SM-146/31, 33 p.; Selected Water Resources Abstracts, 3(23): p. 42.

The Connecticut Yankee Atomic Power Company discharges its effluent into the Connecticut River at a temperature of 12.4 degree C above that at intake and at a rate of 1400 m cu/min. To determine the effects of the effluent, the preoperative phase while the plant was being built (1965-1967) was compared with the operative phase (1968-present). Included in this comparison were present and past studies of physical and chemical characteristics of the lower reaches of the river, of the benthic fauna, of the population dynamics of the resident fish fauna, and of the fish kills. Salmon restoration in the river would not be affected by electric generating plants. River water was being effectively used for the production of electricity with minimum harmful environmental disruption. The short term observation failed to take into account subtle, long-term effects which were not predictable at that time. By 1971-1972, much more information will be available to determine the success of shad emigrating past the Connecticut Yankee effluent, but presently, the harm is outweighed by the benefits. Forty-five references are included.

13426. Berg, Ronald J., and John J. Magnuson (Water Resources Center, Wis. Univ., Madison, Wisconsin). 1970. VARABILITY OF WINTERKILL SURVIVAL IN FISHES. Final Report, Univ. of Wis., Water Resources Center, 1970, 40 p., available from the NTIS as PB-194 031, $3.00 in paper, $0.65 in microfiche; Selected Water Resources Abstracts, 3(23): p. 42.

Dissolved oxygen concentrations lethal to yellow perch from Grassy Lake, which has a history of winterkill, were compared with concentrations lethal to yellow perch from Trout Lake, which does not winterkill, to determine if yellow perch from Grassy Lake were more tolerant. Closed system respirometers (57kliter aquaria containing 24 liters of water with mineral oil) were used. Dissolved oxygen was determined by the Alsterberg modification of the Winkler method. Winter experiments taken directly from both lakes and with yellow perch which were taken from both lakes and then acclimatized to aerated holding ponds. Mean oxygen concentrations lethal to ten fish (8 to 32 g) taken directly from Grassy Lake which were acclimatized to aerated ponds were 0.15 mg and 0.35 mg/liter, respectively. Mean oxygen concentrations lethal to ten fish (12 to 16 g) taken directly from Trout Lake, and twenty fish (10 to 83 g) from Trout Lake which were acclimatized to aerated ponds were 0.36 mg and 0.45 mg/liter respectively. During the summer yellow perch from Grassy Lake were still more tolerant to low oxygen than those taken from Trout Lake. Mean oxygen concentrations lethal to twenty fish (8 to 38 g) from Grassy Lake, and eighteen fish (9 to 22 g) from Trout Lake were 0.32 and 0.81 mg/liter, respectively.

13427. Hanes, D., H. Krueger, I. Tinsley, and C. Bond (Dept. of Fish. and Wildl., Oregon State Univ., Corvallis, Oregon). 1968. INFLUENCE OF PENTACHLOROPHENOL ON FATTY ACIDS OF COHO SALMON (Oncorhynchus kisutch). Proc. of Western Pharmacological Soc. II, pp. 121-125; Selected Water Resources Abstracts, 3(23): p. 44.

Control salmon catabolized 25% of their available fatty acids (mass in diet plus mass in Day 0 salmon) over a 14-day period compared to 47% in KPCP poisoned salmon. Individual fatty acids showed a tendency to be either lost or conserved due to their different rates of net catabolism. The tendency of each acid to be lost or conserved was the same in both untreated and KPCP (potassium pentachlorophenol) poisoned salmon. The excess net catabolism of each fatty acid in salmon

under KPCP poisoning was directly proportional to the available mass of that fatty acid.

13428. Solly, S. R. B., and Valerie Shanks (Dept. of Agric., Wellington, New Zealand). 1969. ORGANOCHLORINE INSECTICIDES IN RAINBOW TROUT FROM THREE NORTH ISLAND LAKES. New Zealand Journal of Marine and Freshwater Research, 3(4): 585-590; Selected Water Resources Abstracts, 3(23): p. 45.

From 12 rainbow trout (Salmo gairdneri Richardson) taken from each of three lakes, (Rerewhakaaitu, Opouri and Okataina) in the Rotorua district, N. Z., samples of liver, skeletal muscle and from mature fish, the gonads were examined for organochlorine insecticides. Lindane, Heptachlor and heptachlor epoxide were not detected in any of the samples. Traces of dieldrin were detected only in trout taken from Rerewhakaaitu Lake. In all fish examined, pp'-DDT, pp'-DDD and pp'-DDE were detected all three tissues. The highest concentrations were found in some of the ovaries of fish from Rerewhakaaitu Lake, the catchment area of which had been extensively topdressed with DDT. Although most of the catchment area of Lake Okataina had never been topdressed with DDT, fish from this lake contained small amounts of DDT and its metabolites.

13429. Eales, J. G. (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1970. BILIARY EXCRETION OF RADIOTHYROXINE BY THE BROOK TROUT, Salvelinus fontinalis (Mitchill). General and Comparative Endocrinology, 14(2): 385-395.

Intraperitoneally injected ^{125}I-L-thyroxine rapidly enters the bloodstream and is distributed to the tissues. Considerable amounts are taken up by the liver and excreted into the bile and intestine, principally as some unidentified derivative(s) of ^{125}I-L-thyroxine.

13430. Wells, LaRue (Bur. Comm. Fish., Great Lakes Fish. Lab., Ann Arbor, Michigan). 1970. EFFECTS OF ALEWIFE PREDATION ON ZOOPLANKTON POPULATIONS IN LAKE MICHIGAN. Limnol. & Oceanogr., 15(4): 556-565.

The zooplankton populations in southeastern Lake Michigan underwent striking, size-related changes between 1954 and 1966. Forms that declined sharply were the largest cladocerans (Leptodora kindtii, Daphnia galeata, and D. retrocurva), the largest calanoid copepods (Limnocalanus macrurus, Epischura lacustris, and Diaptomus sicilis), and the largest cyclopoid copepod (Mesocyclops edax). Two of these, D. galeata and M. edax (both abundant in 1954), became extremely rare. Certain medium-sized or small species increased in numbers: Daphnia longiremis, Holopedium gibberum, Polyphemus pediculus, Bosmina longirostris, Bosmina coregoni, Ceriodaphnia sp., Cyclops bicuspidatus, Cyclops vernalis, and Diaptomus ashlandi. Evidence is strong that the changes were due to selective predation by alewives. The alewife was uncommon in southeastern Lake Michigan in 1954 but had increased to enormous proportions by 1966; there was a massive dieoff in spring 1967, and abundance remained relatively low in 1968. The composition of zooplankton populations in 1968 generally had shifted back toward that of 1954, although D. galeata and M. edax remained rare. The average size, and size at onset of maturity, of D. retrocurva decreased noticeably between 1954 and 1966 but increased between 1966 and 1968. (Auth.)

13431. Hochachka, P. W., D. E. Schneider, and A. Kuznetsov (Dept. of Zool., Univ. of Brit. Columbia, Vancouver, Brit. Columbia, Canada). 1970. INTERACTING PRESSURE AND TEMPERATURE EFFECTS ON ENZYMES OF MARINE POIKILOTHERMS: CATALYTIC AND REGULATORY PROPERTIES OF FDPase FROM DEEP AND SHALLOW-WATER FISHES. Marine Biology, 7(4): 285-293.

At low temperature (3°C), and in the absence of substrate and cofactor, the enzyme, fructose diphosphatase (FDPase), extracted from liver of the benthic fish Coryphaenoides acrolepis, is reversibly inactivated by exposure to relatively low pressures (5,000 psi). At pressures of 20,000 psi at 3°C the native enzyme is irreversibly denatured. When the cofactor and the substrate are present, the enzyme is protected against pressure denaturation; hence, catalysis is insensitive to at least 10,000 psi at 3°C. Similarly, interactions between FDPase and its

negative modulator adenosine monophosphate (AMP), are largely pressure insensitive. Pressure sensitivity of the native enzyme and of the catalytic process is much reduced at temperatures above about 9°C. The homologous enzyme from a surface fish, Pimelometopon pulchrum, is strikingly more senstive to pressure, particularly at low temperatures. (Authors)

13432. Detwyler, R., and E. D. Houde (Dept. of Biol., Norwich Univ., Northfield, Vermont). 1970. FOOD SELECTION BY LABORATORY-REARED LARVAE OF THE SCALED SARDINE Harengula pensacolae (PISCES, CLUPEIDAE) AND THE BAY ANCHOVY Anchoa mitchilli (PISCES, ENGRAULIDAE). Marine Biology, 7(3): 214-222.

Food selection by laboratory-reared larvae of scaled sardines Harengula pensacolae, and bay anchovies Anchoa mitchilli, was compared. Natural plankton was fed to the larvae during the 22 days following hatching. Food levels in the rearing tanks were maintained at an average of 1,600 to 1,800 potential food organisms per liter. Larvae of both species selected as food copepod nauplii, copepodites, and copepods; initial feeding was on organisms of 50 to 75 μ body width. Larvae of H. pensacolae averaged 4.2 mm in total length at hatching and those of A. mitchilli about 2.0 mm. H. pensacolae larvae grew about 1.0 mm per day and A. mitchilli 0.80 mm per day. The mean number of food organisms in each digestive tract was greater in H. pensacolae than in A. mitchilli, and the difference in number increased as the larvae grew. Average size of food organisms eaten increased for both species with growth, because of selection by the larvae; the average size of copepodites and copepods in digestive tracts increased at a faster rate in H. pensacolae than A. mitchilli. A. mitchilli longer than 8 mm did not eat copepod nauplii. (Authors)

13433. Hass, H. (Inst. für Hydrobiol. und Fischereiwiss. der Univ. Hamburg, Hamburg, West Germany). 1969. DIFFERENCES BETWEEN THE LARVAE OF SEVERAL SPECIES OF CLUPEIFORMES LIVING IN THE RIVER ELBE. Arch. FischWiss., 20(1): 22-25. In German.

A way is shown to distinguish larvae of Clupeiformes living in the river Elbe. The larvae of several species may occur in the same part of a river. (Auth. summ.)

13434. Meske, Ch. (Max-Planck Inst. for Kulturpflanzenzüchtung Hamburg - Volksdorf, West Germany). 1969. REARING OF ELVERS IN AQUARIA. Arch. FischWiss., 20(1): 26-32. In German.

About 1000 elvers were raised in special cages attached in aquariums at a permanent water temperature of 23°C. Partly very good growth performance was observed under varying feeding conditions. Elvers fed with fresh fish and dry food weighed more than 100 g each after seven months. The possibility of actually rearing eels in warm water as well as factors which may contribute to the size differentiation of eels of the same age are discussed. (Auth. summ.)

13435. Molnar, Gy (Inst. für Zool. der Agrarwissensch. Univ. zu Gödölló, Hungary). 1969. TO THE HAEMATOLOGY OF EAST ASIAN HERBIVOROUS KINDS OF CARPS: SPOTTED SILVER-CARP, Hypophthalmichthys nobilis Richardson, WHITE SILVER-CARP, Hypophthalmichthys molitrix Val., AND GRASS-CARP, Ctenopharyngodon idella Val. Arch. FischWiss., 20(1): 98-105. In German.

The author examined the haematological picture of the dotted and white carp fish (Hypophthalmichthys nobilis Richardson, Hypophthalmichthys molitrix Val.), the carp (Cyprinus carpio L.), and the grass carp (Ctenopharyngodon idella Val.). Numerical data on the red and white blood cell count, on the haematocrit, haemoglobin, pH, P, Ca, K, Na and on the blood sugar values of the four species are supplied. Relationship between the erythrocyte and haemoglobin has been discovered. The author assumes that hit "M" factor (haemoglobin content per red blood cell) can be applied for other fish species as well. The author continues to examine the changes to the "M" factor, introduced by him, under different environment factors, by species and living sites, to clarify the deeper relationships and correlations. By the help of correlation values he points out that there is a relationship between the blood picture and the food of vegetable or animal origin. This statement is proved also by other blood component values. (Auth. summ.)

13436. Sholkovitz, Edward R. (Scripps Inst. of Oceanogr., Univ. of Calif., San Diego, La Jolla, California). 1970. A FREE VEHICLE BOTTOM-WATER SAMPLER. Limnol. & Oceanogr., 15(4): 641-644.

A free vehicle which samples water at 20-cm intervals for the first 2 m above the ocean sediment is described. The free vehicle approach enables closely spaced water sampling just above the ocean sediment interface for studying chemical gradients. (Auth.)

13437. Jacobsen, Vøgg H. (Danish Inst. for Fish. and Mar. Res., Charlottenlund Slot, Denmark). 1970. A SIMPLE TOOL FOR COLLECTING BURROWING ANIMALS IN SUBMERGED AREAS. Limnol. & Oceanogr., 15(4): 646-648.

A simple tool (the "lug-up"), used by fishermen along the northern coast of Øresund for centuries is described. It can be used in water up to about 1 m deep to recover animals without injury.

13438. Ruggieri, George D., S. J., Ross F. Nigrelli, P. M. Powles, and D. G. Garnett (Osborn Labs. of Mar. Sci., N. Y. Aquarium, N. Y. Zool. Soc., Brooklyn, New York). 1970. EPIZOOTICS IN YELLOWTAIL FLOUNDER, Limanda ferruginea Storer, IN THE WESTERN NORTH ATLANTIC CAUSED BY Ichthyophonus, AN UBIQUITOUS PARASITIC FUNGUS. Zoologica, 55(3): 57-62, with plates.

Yellowtail flounders (Limanda ferruginea) were collected from several areas off Nova Scotia and analyzed for Ichthyophonus. The infection was confined to flounders from the Sable Island Bank and Western Bank. Extensive lesions caused by the fungus were present in the heart, liver, kidney, spleen, gastrointestinal tract, and body musculature. The gills, gall bladder, brain, and testes were mildly infected. All developmental stages of the fungus were observed, although in most histological sections the fungi appear as "resting" or as stages in germination and hyphal development. An analysis of infected fish indicates no relationship to sex and that yellowtails in the size range from 24 cm to 40 cm are more heavily infected. The pathological manifestations of the fungus in the various organs and their significance are discussed. (Authors)

13439. Reichenbach-Klinke, H.-H. (Zool.-Parasitolog. Inst. der Univ. München, Germany). 1969. INVESTIGATIONS ON ENZYMES IN FISH. I. ENZYME-ACTIVITY IN DEPENDENCE OF pH, TEMPERATURE AND WATER COMPOSITION. Arch. FischWiss., 20(2/3): 169-177. In German.

The enzymatic activity has been determined for trypsin, chymotrypsin and α-amylase of rainbow trout (Salmo gairdneri Rich.) and whitefish (Coregonus lavaretus L.) on 125 specimens. The pH value ranges from 2.8-5.8 in healthy stomachs of rainbow trout; in trout with viral hemorrhagic septicemia - from 6-9. The enzymes measured are temperature dependent. Trypsin and chymotrypsin showed an optimum for trout and whitefish at 25°C; amylase at 26-28°C for trout, 25°C for whitefish. Different water pollutants - phenol, detergents (Marlon A) and medications - cupravit, malachite green - inhibit the enzymatic action. (Auth. summ.)

13440. Lang, K. (Prf. Dr. Dr. Lang, 7812 Bad Krotzingen, Schwarzwaldstrasse 71, Germany). 1969. PHYSIOLOGICAL PROPERTIES OF FISH OILS AND FATS. Arch. FischWiss., 20(2/3): 148-163.

13441. Reichenbach-Klinke, H.-H., and K.-E. Reichenbach-Klinke (Zool.-Parasitol. Inst. und dem Inst. für klinische Chemie und klinische Biochemie der Univ. München, Germany). 1970. INVESTIGATIONS ON ENZYMES IN FISH. II. TRYPSIN- AND α-AMYLASE INHIBITORS. Arch. FischWiss., 21(1): p. 67. In German.

The inhibitory effect of tapeworms and organ extracts on the intestinal enzymes of fish has been studied. Living tapeworms of the species Proteocephalus longicollis (Zeder) inactivated trypsin amounts up to 200 m μ per g of intestine; with extracts of macerated worms the effect was 10-30% higher. α-amylase is inactivated by worm extracts up to 48 SE. The inhibitory effect of organs of freshwater and marine fishes on trypsin was determined. It was especially high in liver and skin, and increased in diseased animals. (Authors summ.)

13442. Jancovic, M., and H. Mann (Inst. für Küsten - und Binnenfischerei der Bundesforschungsanstalt für Fischerei, Hamburg, Germany). 1969. EXPERIMENTS ON THE ACUTE TOXIC EFFECT OF NITRILOTRIACETATE (NTA). Arch. FischWiss., 20(2/3): 178-181. In German.

The acute toxic effect of nitrilotriacetate disodium salt of EDTA (NEDTA) was examined. The lethal concentrations for all three substances are above 200 mg/l for tubificids, brine shrimp, prawns, gammarids, copepods, guppies, eel fry and rainbow trout fry. The toxic effect of equal concentrations is always greater in sea water than in fresh water. (Authors summ.)

13443. Rauck, G. (Inst. für Küsten - und Binnenfischerei der Bundesforschungsanstalt für Fischerei, Hamburg, Germany). 1969. A SIMPLE WAY FOR TAGGING FLAT FISH BY MEANS OF A TAGGING GUN. Arch. FischWiss., 20(2/3): 186-187. In German.

Since January 1968 experiments have been carried out to tag adult flatfish by means of two red smooth plastic discs (3 cm O) mounted by a double injection needle with perlon monofilaments on each side of the flatfish. A tagging gun is used for simpler and quicker mounting of the tag. This method has been used successfully on about 5200 flatfish in the German Bight from June to September 1969. (From auth. summ.)

13444. Ackman, R. G. (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1967. CHARACTERISTICS OF THE FATTY ACID COMPOSITION AND BIOCHEMISTRY OF SOME FRESH-WATER FISH OILS AND LIPIDS IN COMPARISON WITH MARINE OILS AND LIPIDS. Comp. Biochem. Physiol., 22: 907-922; 1967 Studies, Part 2, Fish. Res. Bd. Canada, pp. 465-480, 1968, FRB Studies No. 1189.

13445. Allen, K. R. (Fish. Res. Bd. Canada, St. Andrews, New Brunswick, Canada). 1967. A REVISED ESTIMATE OF THE RATE OF GROWTH BETWEEN GREENLAND AND HOME WATERS OF SALMON FROM THE MIRAMICHI RIVER, NEW BRUNSWICK, CANADA. International Commission for the Northwest Atlantic Fisheries, Redbook 1967, Part III, pp. 66-68; 1968 Studies, Part I, Fish. Res. Bd. Canada, pp. 225-227, 1968, FRB Studies No. 1217.

13446. Hughes, G. M., and R. L. Saunders (Res. Unit for Coop. Animal Respiration, Bristol Univ., England). 1970. RESPONSES OF THE RESPIRATORY PUMPS TO HYPOXIA IN THE RAINBOW TROUT (Salmo gairdneri). J. exp. Biol., 53(3): 529-545.

Unanaesthetized rainbow trout, when subjected to a lowered P_{O_2} of the inspired water, show an increase in amplitude of pressures recorded from the buccal and opercular cavities. Pressure amplitudes were commonly found to be 0.5 cm of water in resting trout and increased 4- or 5-fold as inspired P_{O_2} was reduced. Differential pressures across the gills also increased with hypoxia. Typically the minute volume in a 400-600 g trout increased from about 0.2 to 0.6 l/kg/min when the inspired P_{O_2} was lowered from 150 to 80 mm Hg, but rose to 1-5 l/kg/min at lower P_{O_2}. Increased minute volumes are mainly due to increases in stroke volume; respiratory frequency remains fairly constant at P_{O_2}'s above about 80 mm Hg. The relation between differential pressure and minute volume is fairly linear over much of the range, but minute volume increases more rapidly than differential pressure. Oxygen consumption of the non-swimming fish increases during hypoxia and is related to the increased ventilation and differential pressure across the gills. Estimates of the oxygen cost of breathing were made from the increased oxygen consumption during hyperventilation. Comparison of these estimates with estimates of the work done, using the pressure and volume measurements, gave figures for the overall efficiency of the pumping mechanism of about 10%. (Authors summ.)

13447. O'Connell, C. P., and L. P. Raymond (Bur. Comm. Fish.-Oceanogr. Center, La Jolla, California). 1970. THE EFFECT OF FOOD DENSITY ON SURVIVAL AND GROWTH OF EARLY POST YOLK-SAC LARVAE OF THE NORTHERN

ANCHOVY (Engraulis mordax Girard) IN THE LABORATORY. Journal of Experimental Marine Biology and Ecology, 5(2): 187-197.

Populations of 100 eggs hatched in small containers were used to determine the effect of six levels of zooplankton feeding on the survival and growth of larval northern anchovy (Engraulis mordax Girard) over the first 12 days of life. During the sixth and seventh days after hatching there was a drastic mortality in containers receiving 1 copepod nauplius/ml/day or less, but not in containers receiving 4 nauplii/ml/day or more. Subsequent mortality was low in all containers and the size of populations receiving between 0.1 and 4 nauplii/ml remained approximately proportional to the feeding level. Average length of survivors at the end of the experiment varied with feeding level and larvae receiving 4 nauplii/ml/day and 8 nauplii/ml/day had grown 2.5 and 3 times as much respectively as those receiving 1 nauplius/ml. It is suggested that differences in the availability of food may contribute to fluctuations in year-class strength in the sea through the degree of mortality resulting from starvation at the time of yolk nutrition failure, or through the duration of the vulnerable larval period as determined by growth rate. (Authors)

13448. Potts, W. T., and W. R. Fleming (Dept. of Zool., Univ. of Missouri, Columbia, Missouri). 1970. THE EFFECTS OF PROLACTIN AND DIVALENT IONS ON THE PERMEABILITY TO WATER OF Fundulus kansae. J. exp. Biol., 53(2): 317-327.

Measurements have been made of the rate of exchange of tritiated water in both intact and hypophysectomized Fundulus kansae in a variety of media. Hypophysectomy reduces the rate of exchange in fresh water. Low doses (30 mμ) of ovine prolactin stimulate water turnover in hypophysectomized fish in fresh water. The rate of exchange declines in both intact and hypophysectomized animals with increasing salinity. Experiments with synthetic solutions show that the decline in the rate of exchange in sea water and in higher salinities is due mainly to the effects of calcium ions. Fishes maintained in synthetic sea water containing a low concentration of calcium have both a higher rate of exchange of tritiated water and a higher drinking rate than fish in normal sea water. (Authors summ.)

13449. Hochachka, P. W., and J. K. Lewis (Dept. of Zool., Univ. of British Columbia, Vancouver, B. C., Canada). 1970. ENZYME VARIANTS IN THERMAL ACCLIMATION. TROUT LIVER CITRATE SYNTHASES. J. Biol. Chem., 245(24): 6567-6573.

Citrate synthase occurs in two kinetically distinguishable forms, termed C and W in cold and warm acclimated trout, respectively. Oxalacetate and acetyl-CoA saturation curves for both enzymes are hyperbolic and do not show any substrate inhibition. The apparent Km values for the C form increase with temperature above 10°. At saturating (0.1 mM) levels of oxalacetate, the Km of acetyl-CoA is 0.05 mM at 10°, about one-fifth the value at 35°. At saturating levels of acetyl-CoA, the Km of oxalacetate is 7 μM at 10°, about one-fourth the value at 35°. These values at low temperature are similar to the Km constants for the W form below 15°, but above 15°, the Km values for the W form are distinctly lower than for the C form. In the upper biological temperature range for both cold and warm acclimated trout, the Q_{10} for citrate synthase is about 1.0 at low substrate concentrations because the increase in Km compensates for the increasing thermal energy. At saturating substrate concentrations, the temperature characteristics of the two enzymes are the same, and the calculated activation energies are 8.8 kcal per mole. Both C and W forms of citrate synthase are strongly inhibited by ATP, which increases the Km of acetyl-CoA (5-fold at pH 7.5 and 22°) but does not alter the calculated V_{max}. ATP inhibition is noncompetitive with respect to oxalacetate, and the oxalacetate saturation curve remains hyperbolic in the presence of ATP. The K_i of ATP for the C form increases dramatically with temperature above 15°, while the K_i of the W form is thermally insensitive to nearly the lethal limit for trout. The calculated V_{max} values for both C and W forms increase 4-fold between pH 6.5 and 8.5, but the Km values are rather insensitive to pH changes. The K_i of ATP, on the other hand, increases 4-fold between pH 6.5 and 8.5. Since the pH in poikilotherms increases at low temperature, these effects of pH on citrate synthase may (a) reduce the Q_{10} of the reaction irrespective of substrate concentrations, and (b) reduce thermal effects on ATP inhibition. (Authors summ.)

13450. Rabe, Fred W. (Dept. of Biol. Sci., Univ. of Idaho, Moscow, Idaho). 1970. BROOK TROUT POPULATIONS IN COLORADO BEAVER PONDS. Hydrobiologia, 35(3-4): 431-448.

A habitat inventory and evaluation of the brook trout populations from 57 beaver ponds in Colorado permitted comparisons of stunted and non-stunted populations of fish and the environmental conditions under which the populations occurred. High standing crops of small fish were usually present in ponds with favorable spawning areas. Seep ponds with few gravel or sandy areas did not favor spawning. As a result, a smaller number of larger fish were recovered. Four-to-five-inch stunted trout reached maturity at the end of their second growing season while non-stunted trout matured at the end of their third and fourth growing seasons at lengths of seven to eight inches. (Auth. summ.)

13451. Greer, G. L., and D. R. Gardner (Dept. of Biol., Carleton Univ., Ottawa, Ontario, Canada). 1970. TEMPERATURE-SENSITIVE NEURONS IN THE BRAIN OF BROOK TROUT. Science, 169(3951): 1220-1222.

The brain temperature of trout (Salvelinus fontinalis) was altered by perfusion of the gills with warm or cool water. Neuronal activity was recorded with micro-electrodes. Twelve neurons responded to an increase in temperature with increased activity, and five neurons responded to a decrease in temperature with an increase in activity. (Authors)

13452. Noble, Robert W., Lawrence J. Parkhurst, and Quentin H. Gibson (Dept. of Biochem. and Mol. Biol., Cornell Univ., Ithaca, New York). 1970. THE EFFECT OF pH ON THE REACTIONS OF OXYGEN AND CARBON MONOXIDE WITH THE HEMOGLOBIN OF THE CARP, Cyprinus carpio. J. biol. Chem., 245(24): 6628-6633.

Between pH 8 and pH 5.6 at 20° the oxygen affinity of carp hemoglobin decreases by a factor of more than 100; and at pH 5.6, where the lowest affinity is found, all heme-heme interaction is apparently lost. The kinetic constant which is most affected is the rate of oxygen dissociation, which increases by a factor of about 100, whereas the rate of combination of oxygen decreases by only 3-fold It appears that the properties of all of the heme groups of the hemoglobin molecule are affected in a nearly identical way by the pH changes. It is suggested that perhaps at low pH the carp hemoglobin molecule fails to undergo the transition to the high affinity or oxygenated hemoglobin structure and remains in the deoxygenated or low affinity structure even when it reacts with oxygen. (Authors summ.)

13453. Bailey, George S., Allan C. Wilson, John E. Halver, and Clarence L. Johnson (Dept. of Biochem., Univ. of Calif., Berkeley, California). 1970. MULTIPLE FORMS OF SUPERNATANT MALATE DEHYDROGENASE IN SALMONID FISHES. BIOCHEMICAL, IMMUNOLOGICAL, AND GENETIC STUDIES. J. biol. Chem., 245(22): 5927-5940.

Salmon generally possess three forms of supernatant malate dehydrogenase whose subunit compositions are indicated by the formulas AA, AB, and BB. Each of the homo-dimers (AA and BB) has now been purified to homogeneity. The two enzymes are similar in molecular size and in catalytic properties to the supernatant malate dehydrogenases of higher vertebrates; both are catalytically distinct from the mitochondrial form of this enzyme in salmon as well as in higher vertebrates. The two enzymes differ significantly in amino acid composition. The compositional differences are small enough to suggest that the amino acid sequences of A and B subunits are related. Such a relationship is supported by immunological experiments conducted with rabbit antisera prepared against the purified enzymes. These findings suggest that the A and B subunits are the products of duplicate genes which have undergone limited evolutionary divergence. Salmon and trout populations were examined by electrophoresis for malate dehydrogenase variants. The B-type subunit was found to exist in two common forms, B and B'. Most king salmon were found to produce only the B form, whereas most rainbow trout possess the B' form. A few salmon and trout were observed to be heterozygotes producing both the B and B' subunits. By chromatographic and densitometric determination, most rainbow trout heterozygotes possessed a distinctly asymmetrical

1:6:9 ratio of the three enzymes, BB, BB', B'B'; in contrast, king salmon heterozygotes possessed a 9:6:1 ratio of BB, BB', and B'B'. The genetic basis of these peculiar ratios was investigated by matings of heterozygous and homozygous salmon. The offspring were grown for 4 months and tested electrophoretically for the presence and ratio of B and B' subunits. The results demonstrate that salmon possess not one but two genetic loci for the B-type subunit of supernatant malate dehydrogenase. Isoenzyme dosage studies with brown trout suggest that duplicate genes also exist for the A-type subunit. We conclude that two rounds of gene duplication for supernatant malate dehydrogenase have taken place before or during the evolution of salmonid fishes. (Authors summ.)

13454. Krogius, F. V., Ye. M. Krokhin, I. I. Kurenkov, and V. V. Menshutkin (Kamchatka Dept., TINRO, Inst. of Evol. Physiol. and Biochem., AS USSR, Leningrad, USSR). 1969. AN ANALOG OF THE ECOSYSTEM OF LAKE DAL' NEYE. Hydrobiological Journal (Gidrobiologicheskiĭ Zhurnal), published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp., 5(5): 1-7.

A functional model has been produced of the ecosystem of Lake Dal'neye (Kamchatka) for the electronic digital computer. The model takes into consideration hydrologic processes occurring in the water of the lake, phytoplankton production, the development of bacteria, and the population dynamics of zooplankton crustaceans and fishes. The model has been used to investigate the results of the effect on the ecosystem of intensified fishing, alteration in the amount of precipitation, and other external influences.

13455. Mel'nichuk, G. L. (Inst. of Hydrobiol., AS Ukr. SSR, Kiev, USSR). 1969. METABOLIC RATE IN YOUNG COMMERCIAL FISHES OF KREMENCHUG RESERVOIR. Hydrobiological Journal (Gidrobiologicheskiĭ Zhurnal), published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp., 5(5): 41-45.

Mean metabolic level in young carp-bream, carp, pike-perch, and roach in the estuarine stretch of the Ol'shanka River (Kremenchug Reservoir) is dependent on the weight of the fishes and is expressed by a parabolic equation of an exponential function of the type: $Q = aW^k$. Parabolic equations were derived for young carp-bream with a mean weight of 0.1 - 65 g ($Q = 0.43 \cdot W^{0.92}$), carp with a mean weight of 1.72 - 137 g ($Q = 0.80 \cdot W^{0.76}$), pike-perch with a mean weight of 0.76 - 109 g ($Q = 0.44 \cdot W^{0.87}$), and roach with a mean weight of 0.145 - 29 g ($Q = 0.47 \cdot W^{0.87}$). The parameters obtained for the equation of mean metabolic level are slightly different from those of G. G. Vinberg's "basic equation" for freshwater fishes, which is evidently related to the higher metabolism in the young in comparison with adult fishes.

13456. Tugarina, P. Ya., and L. N. Ryzhova (Baikal Biol. Sta., Biol. and Geogr. Res. Inst., Dept. of Vert. Zool., Irkutsk St. Univ., USSR). 1969. AN ECOLOGICAL AND PHYSIOLOGICAL DESCRIPTION OF THE YOUNG OF THE BAIKAL BLACK GRAYLING. Hydrobiological Journal (Gidrobiologicheskiĭ Zhurnal), published by Amer. Fish. Soc., in cooperation with Scripta Publishing Corp., 5(5): 46-50.

The low and high temperature pessima (poorest conditions), the optimum temperature, oxygen consumption, and threshold concentrations of oxygen, and also the rate of increase in length and weight have been determined for young Baikal black grayling (Thymallus arcticus baicalensis Dybowski) in experiments in which temperature, oxygen, and food were varied. It is concluded that the young of the species exhibits high ecological valence (especially up to an age of 3 months), and on this basis it may be recommended for the stocking of a number of bodies of water provided that the young are first reared to hardy stages.

13457. Lambou, Victor W. (Okla. Fishery Research Laboratory, Univ. of Okla., Norman, Oklahoma). 1966. RECOMMENDED METHOD OF REPORTING CREEL SURVEY DATA FOR RESERVOIRS. Oklahoma Dept. of Wildlife Conservation Bull. No. 4, 40 p.

13458. Anonymous. 1970. THE SALMON RESEARCH TRUST OF IRELAND INCORPORATED ANNUAL REPORT NO. 14 FOR THE YEAR ENDED 31ST DECEMBER 1969. (Iontaobhas Taighde Bradan na h-Eireann Ioncorportha). Sponsored by Arthur Guinness & Co., Ltd. and the Minister for Agriculture and Fisheries, 107 p.

Includes: Staff, installations; rainfall and water temperature; rearing of salmon of known ancestry; salmon and sea trout hybrids; feeding and rearing experiments; fish movements; smolt tagging and marking; recaptures of wild grilse tagged as smolts; recoveries of adult salmon of known parentage; biological survey work; ulcerative dermal necrosis (salmon disease); peat silt research; general; acknowledgements; Report on the Hydrography of Lough Furnace, and its Planktonic and Littoral Organisms; Notes on the Growth and Ecology of some Plecoptera in the Altahoney River; Peat Silt as a sediment; Report on Biological Investigations of the Peat Silt Research Group; The Fish-trapping Installation at the Salmon Leap, Furnace, Co. Mayo; Statement of Accounts and Balance Sheet.

13459. Radakov, D. V. (A. N. Severtsov Inst. of Evol. Morphol. and An. Ecol., AS USSR, Moscow, USSR). 1970. METHODOLOGICAL PRINCIPLES FOR THE STUDY OF FISH SCHOOLING BEHAVIOR. Journal of Ichthyology, 10(2): 159-165, published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

The methodological basis for study of the schooling behavior of fishes which enables the essence of this biological phenomenon to be most fully and objectively disclosed is the Leninist theory of reflection. The possibilities which exist for understanding of the schooling behavior of fishes in different aspects are different and are determined by whether the biological essence of this phenomenon is studied or only its mechanisms; study of the physiological mechanisms of the schooling behavior of fishes can provide an answer only to the question of how this process occurs, whereas ecological research is essential if the fundamental causes of the process itself are to be clarified; the schooling behavior of fishes should be treated as a biological phenomenon in which internal and external factors form an indissoluble unity.

13460. Verigin, B. V. (Dept. of Ichthyol., Moscow State Univ., USSR). 1970. THE EMBRYOLOGY OF FISHES AND THE GENERAL THEORY OF THE INDIVIDUAL DEVELOPMENT OF ORGANISMS. Journal of Ichthyology, 10(2): 165-177, published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

The historical stages of the idea of the individual development of organisms - the theory of spontaneous generation, preformation and the biogenetic law - are a single general period characterized by the attachment of absolute significance to the adult stage of the organism, by the view that only this state is fully viable in terms of life and evolution. In this respect the biogenetic law is only a historically conditioned variant of preformation and also stems from a metaphysical concept not admitting of new formation in the process of development. The generalizations made by ichthyologists from the study of fish embryology can demonstrate, that it is essential and possible to proceed to a dialectical, genuinely historical understanding of ontogeny, i. e. to a view of the organism as a set of stages, one arising from the other, which are interconnected and interconditioned and of equal value in an evolutionary sense, each of which has the features of its ancestors, and also specific features conditioned by the whole course of historical development. Individual development is here regarded as an all-embracing functional adaptive process, whose driving forces are to be found in the interaction of the organism with the external conditions which are its environment.

13461. Berval'd, E. A., and G. K. Barashkov. 1970. POWER ENGINEERING AND PRESENT-DAY PROBLEMS OF FISHERIES MANAGEMENT IN IMPOUNDMENTS. Journal of Ichthyology, 10(2): 177-183, published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

An examination is made of the changes introduced into the regime and nature of bodies of water by hydraulic engineering works, and also of the changes in the living conditions of anadromous, semi-migratory and nonanadromous fishes. An examination is made of the ways of constructing a rational fishing industry when river discharge is regulated. Mention is made of some of the problems facing

science in connection with the development of the fishing industry under conditions in which multiple use is made of water resources.

13462. Savvaitova, K. A. (Dept. of Ichthyol., Moscow St. Univ., USSR). 1970. MORPHOLOGICAL FEATURES AND VARIABILITY OF LOCAL POPULATIONS OF THE LAKE-RIVER FORM OF THE ARCTIC CHAR [Salvelinus alpinus (L.)] FROM THE KAMCHATKA RIVER BASIN. Journal of Ichthyology, 10(2): 203-217, published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

The paper contains an examination of the morphological features, the coloration and the nature of variability of the characters of allopatric and sympatric populations of the lake-river form of the Arctic char from the upper, middle and lower reaches of the Kamchatka River. An analysis is made of the percentage occurrence of characters in the population and of the variability of individual characters and populations as exemplified by the coefficients of variation and by the relative value of the standard deviations as defined by S. R. Zarapkin. It is established that all the populations are similar and differ only in the frequency of occurrence of various combinations of characters. The similarity of the populations is due to the fact that they belong to a single intraspecies form and to community of existence in the Kamchatka River basin. At the same time, diversity in the specific conditions of existence and some isolation of the populations are a cause of some of the differences found between them. However, the degree of these differences is slight. Nor are there significant differences between the coexisting sympatric populations of "mollusk-eaters" and "predators" from Lake Azabach'ye. The predators are clearly distinguished only by the nature of their food. The question of whether these char belong to a single population or of whether they are two independent, reproductively isolated groups needs further study.

13463. Khalturin, D. K. (White Sea Biol. Sta., Zool. Inst., AS USSR). 1970. A STUDY OF THE BIOLOGY OF THE BROWN TROUT [Salmo trutta (L.)] OF THE KARELIAN ISTHMUS. Journal of Ichthyology, 10(2): 218-228, published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

An examination is made of the size-weight, sexual and age characteristics of spawning populations of the brown trout in the Primorsk and Ladoga Districts of the Karelian Isthmus. The anadromous and lacustrine forms have "winter" and "summer" biological groups. The times of their migrations are indicated in particular in the winter into the Burnaya River (Taypalenyoki). The Chernaya River brown trout is the largest (average weight is 2.3 kg) in the basin of the eastern part of the Gulf of Finland. Its young spend 2-3 years in the river (86%) and in this respect occupy an intermediate position between the brown trout of the Vyaena River and the Kovda River. Some stability is manifested in the duration of the period of life spent in the sea from areas which differ in meridional and latitudinal location. Geographic variability in brown trout ecology has little effect on the duration of its life in the sea before sexual maturity. An analysis is made of the causes of reduction in the numbers of the trout and recommendations are given for improvement of its reproduction.

13464. Pavlovskaya, R. M. (Azov-Black Sea Res. Inst. for Sea Fish. and Oceanogr. (AzCherNIRO), Kerch, USSR). 1970. SPAWNING CONDITIONS AND AN ESTIMATE OF RECRUITMENT OF THE MAJOR SUMMER-SPAWNING FOOD FISHES OF THE BLACK SEA IN 1965-1968. Journal of Ichthyology, 10(2): 229-234, published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

The paper contains an account of the results of four years of observations on the breeding conditions of the main summer-spawning food fishes of the Black Sea - anchovy, horse-mackerel, surmullet and mullet. A description is given of distinctive features relating to the effectiveness of their spawning by individual areas in different years. A quantitative estimate of the recruitment of these fishes in 1965-1968 is given on the basis of a direct count of the young using a pelagic fry trawl.

13465. Doroshev, S. I. (All-Union Res. Inst. for Sea Fish. and Oceanogr. [VNIRO], Moscow, USSR). 1970. BIOLOGICAL FEATURES OF THE EGGS, LARVAE AND YOUNG OF THE STRIPED BASS [Roccus saxatilis (Walbaum)] IN CONNECTION WITH THE PROBLEM OF ITS ACCLIMATIZATION IN THE USSR. Journal of Ichthyology, 10(2): 235-248, published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

An examination is made of features of the development of the larvae and young of striped bass obtained from the USA with a view to rearing and acclimatization in the Azov-Black Sea basin. An account is given of the most important diagnostic characters of the time of transition of the larvae to active feeding. Reference is made to large-scale instances of pathological development encountered in the rearing of young by the intensive method. The salt and temperature ranges of the larvae and young are established, and also their relation to oxygen content in the water, to pH, to the current, to light and to other environmental factors. A qualitative description is given of the food of the larvae and young over the two-month rearing period.

13466. Kanid'yev, A. N., G. M. Kostyunin, and S. A. Salmin [Sakhalin Dept., Pacific Res. Inst. for Sea Fisheries and Oceanogr. (SakhTINRO)]. 1970. HATCHERY PROPAGATION OF THE PINK AND CHUM SALMONS AS A MEANS OF INCREASING THE SALMON STOCKS OF SAKHALIN. Journal of Ichthyology, 10(2): 249-259, published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

The importance of hatchery propagation of pink salmon and chum salmon is increasing, due to the steady decline of Pacific salmon stocks under present conditions. The merits of hatchery propagation, in comparison with natural propagation, are the lesser numbers of adult fishes (7-10 times lower) required to maintain stable stocks, the larger size of the downstream-migrating young and the possibility that fish culturists have of influencing the development of food reflexes and defense reflexes in the young. A comparison is made of the effectiveness of hatchery and river propagation of salmon. Given the present-day cost of propagation, a coefficient of return of 0.55% (without allowance for sea fishing) ensures that hatchery reproduction is comparatively highly profitable.

13467. Golovanenko, L. F., T. F. Shuvatova, Ye. P. Putina, L. S. Fedorova, and A. L. Arakelova (Azov Fish Res. Inst. (AzNIIRKh), Rostov on Don, USSR). 1970. A PHYSIOLOGICAL AND BIOCHEMICAL DESCRIPTION OF DON PIKE-PERCH FEMALES AT DIFFERENT STAGES OF THE SEXUAL CYCLE. Journal of Ichthyology, 10(2): 260-267, published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

It is shown that pike-perch females in stage IV of maturity of the gonads (incomplete) differ significantly from females in stage IVa of maturity (complete) with respect to such physiological and biochemical characteristics as the amount of protein in the gonads, the amount of hemoglobin and the level of total protein serum and lipids in the blood, and the protein and lipid content of the liver. The characteristics established may be used not only to discriminate the level of maturity of the gonads within stage IV, but also to detect influence of the normal process of maturation in the final stages of the sexual cycle.

13468. Kokhanskaya, Evgenia Mikhailovna, Vladislav Antonovich Teodorovich, and Ivan Alexandrovich Sadov (Inst. Morfologii Zhivotnykh Imeni A. N. Severtsova, Moscow, USSR). 1970. BACTERICIDAL WATER STERILIZER FOR FISH ROE INCUBATORS. U. S. Patent 3,507,612 (1970); Comm. Fish. Abstr., 24(1): p. 33, 1971.

This invention deals with a device for sterilizing the water used in fish roe incubators. The inventors claim that the equipment is relatively small, has high sterilization efficiency, and the period of irradiation (bactericidal lamps are used) is relatively short.

13469. Huet, Marcel, and J. A. Timmermans. 1970. FISH CULTURE METHODS. Traite de Pisciculture, 718 p., Ch. de Wyngaert, Brussels (4th edition, 1970), $19.00 clothbound; Nature, 228(5266): 94-95; Comm. Fish. Abstr., 24(1): p. 33.

This fourth edition of Professor Huet's Treatise on Fish Culture is twice the length of the third edition. The chapters on the construction, layout, natural history, and productivity of fishponds have been changed little from those in the previous edition, but those on the management and improvement of fish ponds have been enlarged to include more methods of weed control and more techniques for influencing the chemical and physical factors that govern the size of fish crops. The account of salmoniculture is unchanged in length, but that on carp culture has been enlarged appreciably to include several European and acclimatized Asiatic carps. New chapters are devoted to the culture of pike, pikeperch, walleye, black bass, tilapia, shad, grayling, sturgeon, catfish, mudfish, and eels; to the diseases and enemies of fish; to artificial foods; to harvesting, transport, and care of live fish; to fish culture by regions; and to the culture of fish as a means of restocking water depopulated by engineering works, by pollution, or by excessive fishing.

13470. Liao, Paul B. (Water and Air Resources Div., Univ. of Washington, Seattle, Washington). 1970. POLLUTION POTENTIAL OF SALMONID FISH HATCHERIES. Water and Sewage Works, 117(8): 291-297; Comm. Fish. Abstr., 24(1): p. 35.

This paper reports on work performed by the author on the subject and it includes a survey of the literature, results of a questionnaire survey of agencies operating hatcheries to determine individual problems, and results of field tests to determine the effect of hatchery wastes on receiving water. The review of the literature from standard sources (all North American and many European publications) revealed no articles of any significance relating to fish hatcheries as sources of pollution. The author, however, did obtain four special reports from various sources relating to fish hatchery pollution studies -- these articles are listed in the references section of his report. The author's questionnaire survey of 65 agencies that operate hatcheries revealed that 13 had indicated the existence of pollution problems, 9 had made pertinent research studies, 8 had instituted special pollution control measures, and 18 felt that there was a potential problem of fish hatchery wastes. The author states that as a result of his field tests and observations water pollution problems associated with salmonid hatchery operations involve nutritional enrichment, algal and weed growth, taste and odor, settleable solids, pathogenic bacteria and parasites, organic matter, chemicals, and drugs. The author believes that water pollution from salmonid hatcheries can be controlled through in-hatchery improvements and effluent treatment. Hatchery operations should improve fish loading techniques, feeding practices, and adjustment of water supply. The effluent should be properly treated before it is discharged into the receiving water.

13471. Burton, Boye H. (321 N. E. Russet St., Portland, Oregon). 1970. FISH FOOD DISTRIBUTOR FOR HATCHERY RACEWAYS. U. S. Patent 3, 526, 210; Comm. Fish. Abstr., 24(1): p. 33.

The invention described distributes fish food selectively to, and uniformly over, the areas of a pair of adjacent, elongated hatchery raceways. Food from a hopper is blown through an elongated delivery tube located between the raceways by the air from a fan connected to one end of the tube. At spaced intervals, the tube has oppositely directed lateral outlets. The flow of food through these outlets, and through the tube, can be selectively controlled by an adjustable valve. The distributor can be easily and economically built and quickly and easily installed on existing raceways. It can be controlled either manually or automatically (on a timed sequence).

13472. Bennett, Harry Jackson, and John W. Day, Jr. (Ind. Res. Lab., Louisiana State Univ., Baton Rouge, Louisiana). 1970. ABSORPTION OF ENDRIN BY THE BLUEGILL SUNFISH, Lepomis macrochirus. Chemical Abstracts, 73(1): 2959a; Comm. Fish. Abstr., 24(1): p. 36.

AUTHOR INDEX

Abbott, F. S., 13236
Abdel-Magid, A. M., 13239
Abe, Isao, 13223
Abel, R., 13163
Abelson, Philip H., 13364
Ackman, R. G., 13444
Addison, W. D., 13287
Ahlbert, Inga-Britt, 13392
Ahlstrom, Elbert H., 13159
Aker, E., 13184
Akiyama, Akio, 13232
Albers, R. J. A. M., 13190
Alexander, R. McN., 13374
Al-Kholy, A., 13165
Allen, K. R., 13445
Ames, Warren E., 13352
Anderson, Bobby T., 13299
Andrews, Austin K., 13253
Andrews, C. W., 13237
Anokhina, L. E., 13391
Anonymous, 13458
Antychowicz, J., 13357
Aoe, Hiroshi, 13223
Arai, Ken-ichi, 13214, 13216, 13219, 13228
Arai, Shigeru, 13273
Arakelova, A. L., 13467
Asakawa, Makio, 13209

Babcock, W. H., 13178
Bailey, George S., 13453
Baker, Claude D., 13244
Baker, Myron Charles, 13201
Baker, Phillip H., 13325
Balsiger, James W., 13160
Banks, Joe L., 13295
Bara, Gonül, 13407
Barashkov, G. K., 13461
Barbier, B., 13401
Baronkin, O. F., 13144
Bartnik, Victor G., 13334
Bates, Daniel W., 13365
Bauer, O. N., 13381
Bayeva, G. D., 13144
Bedell, Gerald W., 13301
Bennett, Harry Jackson, 13472
Berg, Ronald J., 13426
Berval'd, E. A., 13461
Beyerle, George B., 13177
Bida, Gerald, 13376
Billard, R., 13402
Bishop, Frank G., 13294
Blaylock, B. G., 13300
Bogdanova, L. S., 13148
Bogoroditskii, P. V., 13359
Bond, C., 13427
Bonnet, L., 13401
Bottroff, Lawrence J., 13319
Bounds, R. L., 13304
Boyd, Claude E., 13131
Boyer, R. L., 13305
Braem, Robert A., 13254
Braithwaite, H., 13155
Brinkley, H. J., 13167
Bross, Michael G., 13318
Brown, Charles E., 13410
Brown, V. M., 13397
Bulow, Frank J., 13349
Bumgarner, Daniel H., 13310
Burkett, Robert D., 13200
Burns, James W., 13316, 13326
Burress, Ralph M., 13130
Burton, Boye H., 13471
Burton, Dennis T., 13313, 13322
Butler, P. A., 13421

Cagle, Jimmy B., 13215
Caillouet, Charles W., Jr., 13267
Cairns, John, Jr., 13168, 13288
Cameron, James N., 13241
Campbell, R. N., 13164
Campbell, Robert S., 13424
Castagna, M., 13238
Chapman, D. W., 13175
Charlon, Nicole, 13401
Chau, Yiu-Kee, 13203
Chen, F. Y., 13337
Chichester, C. O., 13265, 13270
Chieffi, G., 13405
Chikova, V. M., 13138
Chitty, N., 13187
Chubba, Joseph V., 13414
Clem, L. W., 13242
Cohen, Daniel M., 13324
Cole, Charles F., 13353
Coppage, David L., 13385
Cordone, Almo J., 13315, 13325
Craig, P., 13129
Crear, David, 13161

Davis, John C., 13241
Dawley, Earl M., 13193
Dawson, C. E., 13250
Day, Donald, 13333
Day, John W., Jr., 13472
Dekhnik, T. V., 13134
de Kinkelin, P., 13402
Dempster, Robert P., 13195
Denton, Eric, 13332
Derse, Philip H., 13170
Deschamps, Gene, 13281
Detwyler, R., 13432
Didgeon, Bonny, 13131
DiDonato, Gene, 13284
Dixon, Gordon H., 13243
Donaldson, Edward M., 13346, 13347, 13394, 13396

Doroshev, S. I., 13465
Dorozhkina, T. Ya., 13149
Dove, G. Robert, 13252
Drummond, R. A., 13172
Duffy, J. R., 13120
Duka, L. A., 13134

Eales, J. G., 13429
Earnest, Russell D., 13296
Eaton, John G., 13398
Ebel, Wesley, 13193
Eberhardt, L. L., 13263
Edwards, Gary B., 13311
Egusa, Syuzo, 13211, 13269
Ehira, Shigeo, 13208. 13229
Ehrlich, Karl F., 13327
Eisan, J. S., 13393
Elliott, G. V., 13351
Elliott, Joseph W., 13295
Engashev, V. G., 13363
Ennis, G. P., 13335
Etnier, David A., 13199

Fagerlund, Ulf H. M., 13346, 13347, 13394
FAO of the UN, 13260
Farris, David A., 13327
Favreau, M. B., 13236
Federal Water Quality Administration, 13186
Federova, L. S., 13467
Feldmeth, C. R., 13351
Fenwick, James C., 13404
Ferguson, Denzel E., 13366
Finley, Mack T., 13366
Finnin, Barrie C., 13370, 13375
Fisher, W. K., 13192
Fleming, W. R., 13448
Fowler, Laurie G., 13295
Frantz, Ted C., 13325
Fredeen, F. J. H., 13125
Freeman, Robert A., 13245
Frost, R. H., 13190
Fry, F. E. J., 13152
Fryer, J. L., 13289, 13382
Fulton, Leonard A., 13196

Gardiner, George R., 13338
Gardner, D. R., 13451
Gardner, Michael L. G., 13154
Garnett, D. G., 13438
Gasaway, Charles R., 13331
Gaydash, Yu. K., 13145
Ghittino, P., 13356
Gibson, Quentin H., 13452
Gloxhuber, Ch., 13192
Goldberg, Edward K., 13420
Golovanenko, L. F., 13467
Gomez, Ricardo, 13286
Gordy, Herbert R., 13293
Grant, Blake F., 13342
Gray, R. W., 13237
Greer, G. L., 13451
Griffith, N. A., 13300
Grigoropoulos, Sotirios G., 13205
Grinstead, Bobby Gene, 13291
Gunderson, Don, 13282

Hafeez, M. A., 13408
Haga, Hideo, 13218
Haga, Yoshiko, 13218
Hagino, Tokiko, 13218
Halver, J. E., 13153, 13453
Hanek, George, 13202, 13411
Hanes, D., 13427
Hannan, Herbert H., 13299
Hansen, David J., 13179
Harada, Katsuhiko, 13217
Haraguchi, Tatsuichi, 13230
Harman, Paul D., 13128
Harris, J. E., 13412
Hashimoto, Kanehisa, 13277
Hashimoto, Yoshiro, 13273
Hass, H., 13433
Hatfield, C. T., 13373
Hayashida, Ted, 13415
Hayasi, Sigeiti, 13389
Haydock, Irwin, 13161, 13162
Heard, W. R., 13305
Hell, C. E. B., 13185
Hellawell, J. M., 13163
Hettler, William F., Jr., 13293
Heyl, Henry L., 13403
Hibiya, Takashi, 13235, 13279
Hicks, Don, 13314
Hightower, Frank, Jr., 13215
Hildebrand, Stephen G., 13122
Hirata, Kenji, 13265
Hirayama, Kazutsugu, 13207
Hochachka, P. W., 13431, 13449
Hodgins, Harold O., 13352
Hokanson, Kenneth E. F., 13169
Holeton, George F., 13240
Holland, Hugh T., 13385
Holway, Jamieson E., 13298
Honma, Shinji, 13210
Honma, Yoshiharu, 13210
Houde, E. D., 13432
Howell, W. Mike, 13249
Huet, Marcel, 13469
Hughes, G. M., 13446
Hughes, Robert A., 13400
Hunn, Joseph B., 13130
Hunter, John R., 13317
Hurlburt, E. M., 13344
Hynes, H. B. N., 13116, 13117

Iimori, Masahide, 13230
Iles, Christine, 13115
Imler, Richard, 13307

Ishak, M. M., 13165
Itazawa, Yasuo, 13233, 13276
Iversen, E. S., 13187
Iwanaga, Noriyuki, 13204, 13266

Jackson, William B., 13200
Jacobi, G. Zolton, 13251
Jacobsen, Vøgg H., 13437
Jancovic, M., 13442
Jenkins, T. M., Jr., 13351
Jergil, Bengt, 13243
Jernelov, A., 13422
Johnels, A. G., 13423
Johnson, Clarence L., 13453
Johnson, James E., 13180
Jordan, Carol, 13395

Kabata, Z., 13336
Kaesler, Roger L., 13288
Kakino, Jun, 13204, 13266
Kanazawa, Akio, 13225
Kanid'yev, A. N., 13466
Kanna, Koichi, 13224
Kariya, Teiji, 13218
Kashiwada, Ken-ichi, 13225
Katayama, Teruhisa, 13265, 13270
Kawai, Akira, 13272
Kennamer, Earl F., 13119, 13136
Khashem, M. T., 13137
Khalil, S. R., 13165
Khalturin, D. K., 13463
Khoroshko, P. N., 13132
Kikawa, Shoji, 13387
Kiley, Charles W., 13118
King, Everett L., Jr. 13254
Kira, Keiko, 13211, 13269
Kisker, Dale S., 13354
Kitamikado, Manabu, 13221
Kitamura, Sasaburo, 13223
Kleeman, Karl T., 13289
Klein, David H., 13420
Klima, Edward F., 13181
Klontz, G. W., 13298
Kocylowski, B., 13357
Kokhanskaya, Ye. M., 13146, 13468
Kostyunin, G. M., 13466
Koto, Tsutomu, 13383, 13389
Krivobok, M. N., 13139
Krogius, F. V., 13454
Krokhin, Ye. M., 13454
Krueger, H., 13427
Kuehne, Robert A., 13248
Kuhns, William J., 13414
Kume, Susumu, 13389
Kurenkov, I. I., 13454
Kuz'mina, V. V., 13144
Kuznetsov, A., 13431

LaBar, George W., 13176
Lagios, Michael D., 13415
Lambou, Victor W., 13457
Lang, K., 13440
Lanzing, W. J. R., 13255
Lawrence, James L., 13417
Lederis, K., 13406
Lee, G. Fred, 13400
Lee, Terrence H., 13170
Lennon, Robert E., 13130
Levesque, Raymond C., 13306
Lewis, J. K., 13449
Lewis, Steven A., 13292
Li, M. F., 13158, 13395
Liao, Paul B., 13470
Lichtenheld, Richard W., 13293
Lie, Ulf, 13354
Lindahl, P. E., 13185
Lindsey, C. C., 13330
Ling, Victor, 13243
Ludke, J. Larry, 13366
Luhning, Charles W., 13128
Lunz, G. Robert, 13360
Lupo di Prisco, C., 13405
Lux, F. E., 13198

MacKelvie, R. M., 13123
Madsen, Monte L., 13174
Magnuson, John J., 13426
Mailyan, R. A., 13142
Maitland, Peter S., 13156
Major, Richard L., 13290
Mann, H., 13442
Martin, Duncan W., 13244
Martin, James R., 13262
Masuda, Isao, 13223
Materazzi, G., 13405
Matsumiya, Hiroyuki, 13229
Matsuura, Fumio, 13277
Mayer, F. L., Jr., 13378
McCart, P. 13129
McErlean, Andrew J., 13167, 13379
McFadden, T. W., 13339
McKechnie, Robert J., 13323
McKone, D., 13126
McLain, Douglas R., 13124
McPhail, J. D., 13330
Meeks, R. L., 13263
Mehrle, Paul M., 13342
Mel'nichuk, G. L., 13455
Mel'nikova, M. N., 13135
Menshutkin, V. V., 13454
Merriman, Daniel, 13425
Merriner, John V., 13173
Meske, Ch., 13434
Mihursky, Joseph M., 13379
Miller, Lee W., 13323
Mitchell, Charles I., 13317
Mitson, R. B., 13328
Miura, Shigetsugu, 13217
Mizuno, Masanori, 13204, 13266
Moiseyeva, Ye. B., 13133
Molnar, Gy, 13435
Monk, Bruce, 13193

Morita, Yasuo, 13389
Morley, R. B., 13340
Morton, Stephen D., 13170
Moser, Byron B., 13314
Mounib, M. S., 13393
Moyle, Peter, 13321
Mullison, W. R., 13368
Murphy, Philip G., 13371
Muzykovskii, A. M., 13363

Nair, J. H., III, 13372
Nakagawa, Heisuke, 13386
Nakamura, M., 13258
Nakamura, Takashi, 13268
Neiheisel, T. W., 13172
Nelson, Wesley C., 13189
Neuhold, John M., 13194, 13378
Nichy, F. E., 13198
Nicola, Stephen J., 13315, 13325
Nigrelli, Ross F., 13414, 13438
Nims, Linda, 13382
Nishikawa, Yasuo, 13387
Noble, Robert W., 13452
Nose, Takeshi, 13273

O'Connell, C. P., 13447
Ogino, Chinkichi, 13204, 13220, 13235, 13266, 13279
Oguri, Mikio, 13278
Olifer, S. A., 13355
Omarov, M. O., 13147
Ostroumova, I. N., 13140
Overstreet, Robin M., 13409, 13410
Owen, I. L., 13369

Parisot, Thomas J., 13367
Parker, W. D., 13302
Parker, Wayne L., 13319
Parkhurst, Lawrence J., 13452
Pasquale, Nick, 13284
Patrick, Ruth, 13288
Patten, Benjamin G., 13197
Pavlovskaya, R. M., 13464
Perkins, Herbert C., 13191
Perlmutter, Alfred, 13118
Peterle, T. J., 13263
Peters, Gabriele, 13182
Peters, Hans M., 13247
Peters, Nicolaus, 13182
Phinney, Duane E., 13281
Pilcher, K. S., 13289, 13382
Pitt, T. K., 13345
Plate, G., 13183
Polisini, J. M., 13131
Post, George, 13312
Potts, W. T., 13448
Powles, P. M., 13438
Putina, Ye. P., 13467
Pycha, Richard L., 13121

Qadri, S. U., 13377
Quay, W. B., 13408

Rabe, Fred W., 13450
Radakov, D. V., 13459
Raleigh, R. F., 13175
Rauck, G., 13443
Raymond, L. P., 13447
Recco, Rose A., 13308
Reed, Barry L., 13370, 13375
Reed, Paul H., 13380
Rehwoldt, Robert, 13376
Reichenbach-Klinke, H.-H., 13439, 13441
Reichenbach-Klinke, K.-E., 13441
Reith, Jan F., 13190
Reynolds, James B., 13124
Richards, C. E., 13238
Richards, William J., 13252
Richardson, William M., 13319
Riche, L. G., 13373
Richey, Eugene P., 13283
Ricker, W. E., 13157, 13362
Rio, Guido J., 13308
Risebrough, R. W., 13419
Ritchie, Douglas E., Jr., 13256
Roessler, Martin, 13257
Rothschild, Brian J., 13160
Royer, L. M., 13125
Rozenfel'd, L. S., 13361
Rudling, Lars, 13399
Ruggieri, George D., S. J., 13438
Russell, Warren J., 13413
Ryder, R. A., 13287
Ryzhova, L. N., 13143, 13456

Sadov, Ivan Alexandrovich, 13468
Saha, J. G., 13125
Saito, Kunio, 13220
Saito, Takeshi, 13223
Saito, Tsuneyuki, 13214, 13216, 13219 13228
Saitoh, Hirohumi, 13203
Sakagawa, Gary T., 13121
Sakaguchi, Morihiko, 13272
Salmin, S. A., 13466
Sarot, Daniel A., 13118
Saunders, R. L., 13446
Savitz, J., 13171
Savvaitova, K. A., 13462
Schmitz, Eugene H., 13244
Schneider, D. E., 13431
Schnick, Rosalie A., 13130
Schrijver, C. A., 13190
Schwartz, Frank J., 13360
Sera, Hiroshi, 13271
Sethi, Hari S., 13303
Shafi, Muhammed, 13156
Shanks, Valerie, 13428
Sharma, R. K., 13194
Shaw, D., 13397

Shentyakov, V. A., 13144
Shentyakova, L. F., 13144
Sherman, Kenneth, 13191
Shingu, Chiomi, 13389
Shinoda, Yoshio, 13217
Shipman, William H., 13195
Shipp, Robert L., 13262
Shippen, Herbert H., 13290
Shirota, Akihiko, 13222
Sholkovitz, Edward R., 13436
Shul'man, G. Ye., 13150
Shurben, D. G., 13397
Shuvatova, T. F., 13467
Sigel, M. Michael, 13413
Sinyukova, V. I., 13134
Skinner, John E., 13329
Small, James W., Jr., 13248
Smirnova, N. F., 13144
Smith, C. E., 13127
Smith, John Warren, 13205
Smith, Lloyd L., Jr., 13169
Smith, Michael, 13416
Smith, R. J. F., 13261, 13350
Smith, Roderick M., 13353
Snodgrass, P. J., 13153
Sollitt, Charles K., 13283
Solly, S. R. B., 13428
Solon, J. M., 13372
Spence, J. A., 13116, 13117
Spoor, W. A., 13172
Sprague, J. B., 13120
St. Amant, James A., 13319
Stepanov, V. S., 13144
Stevens, E. Don, 13152
Storeton-West, T., 13328
Street, J. C., 13378
Suda, Akira, 13384, 13388
Suzuki, Tsuneyoshi, 13206

Taguchi, Takeshi, 13234
Takashi, Reiji, 13214, 13219, 13216, 13228
Takashima, Fumio, 13235, 13279
Tarkovskaya, O. I., 13139
Teodorovich, Vladislav A., 13468
Teshima, Shin-ichi, 13225
Theis, G. L., 13309
Thomas, Nelson A., 13358
Thorne, Richard E., 13188
Threlfall, William, 13202, 13411
Tidd, Wilbur M., 13418
Timmermans, J. A., 13469
Timoshina, L. A., 13141
Tinsley, I., 13427
Tokunaga, Toshio, 13231
Toyoda, Toshiko, 13223
Toyomizu, Masamichi, 13268
Traxler, G. S., 13158
Tsuchiya, Nobukuni, 13208
Tsuyuki, H., 13337, 13343
Tugarina, P. Ya., 13143, 13456
Uchiyama, Hitoshi, 13208, 13229
Uda, Fumiaki, 13229
Ueyanagi, Shoji, 13387
Umemoto, Shigeru, 13224
Umminger, Bruce L., 13166
Uto, Masami, 13387
Utter, Fred M., 13352

Van Meter, N., 13187
Van Vliet, W. H., 13377
Veith, Gilman D., 13400
Verigin, B. V., 13460
Vlasenko, A. D., 13132
Vogele, L. E., 13305
Voss, Edward W., Jr., 13413

Wakabayashi, Hisatsugu, 13211, 13269
Walker, M. Greer, 13328
Washington, Percy M., 13320
Watanabe, Takeshi, 13204, 13235, 13266, 13279
Wellborn, Thomas L., Jr., 13297
Wells, LaRue, 13430
Westermark, T., 13423
Westman, Kai, 13151
Westrheim, S. J., 13343
White, R. L., 13304
Whitley, James R., 13424
Wickham, Donald A., 13181, 13215
Williams, F., 13259
Williams, James D., 13249
Wilson, Allan C., 13453
Wilson, Nadine, 13416
Wingfield, William H., 13382
Winter, Donald R., 13246
Winters, G. H., 13341
Withler, F. C., 13340
Witt, Arthur, Jr., 13424
Woodey, James C., 13188
Woodhead, P. M. J., 13348
Wright, Samuel G., 13280, 13285

Yacovino, Joseph T., 13264
Yamada, K., 13258
Yamada, Kinjiro, 13217
Yamaguchi, Katsumi, 13277
Yamamoto, Hiroshi, 13221
Yamashita, Hideo, 13226, 13227
Yamazaki, Fumio, 13396
Yevich, Paul P., 13338
Yokote, M., 13258
Yokoyama, Henry, 13265, 13270
Yoshida, Yoichi, 13212, 13213, 13271, 13274, 13275
Youssef, Y. A., 13165
Yu, Man-Lim, 13118

Zaytsev, K. N., 13144
Zelazny, J., 13357
Zitko, V., 13390

SUBJECT INDEX

Age and growth,
anchovy, northern, larvae, effect of food density, 13447
biostimulators: lysine and terramycin, re growth and condition of market fish, 13361
drum, freshwater, eye lens as indicator, 13200
eel, American, in Newfoundland waters, 13237
fishes, Woods Hole, Mass. area, number and lengths by season, 13198
food,
conversion, effects of temperature on coefficients α', β and γ, Seriola, Gadus, 13275
uptake and conversion efficiency, Seriola, 13274
grayling, age-related changes in blood, Lake Baikal, 13143
growth-control technique, cultured trout, 13310
perch, European, in two Scottish lochs, 13156
reconstruction of growth using white bream, Lake Il'men', USSR, 13149
RNA-DNA ratios as indicators of recent growth rates of a fish, 13349
salmon,
Atlantic,
growth rate between Greenland and home waters, 13445
young in White Sea rivers, 13135
chinook, fingerlings, temperature effects, 13295
kokanee, Lake Tahoe, California, 13325
sculpin, shorthorn, in Newfoundland waters, 13335
trout,
brown, in northern Scottish lochs re fisheries improvement, 13164
lake, in Lake Superior before 1950, 13121
steelhead, in ninth year - taken at sea, 13320
tunas and marlins in Atlantic Ocean, 13389
walleye in Canton Reservoir, Oklahoma, 13292

Anatomy,
bladder, urinary, effect of urophysial substance on, rainbow trout, 13406
brain, temperature-sensitive neurons, brook trout, 13451
cobia, prejuvenile and juvenile, Gulf of Mexico, 13250
condition and fatness of blue bream in Rybinsk Reservoir, 13137
corpuscle of Stannius, changes during spawning migration, Atlantic salmon, 13403
endocrine glands and osmoregulation of teleosts, 13278
epidermis, histochemistry of mucus of eel, 13209
eye lens as age indicator in freshwater drum, 13200
feeding, mechanics of, in various teleosts, 13374
gill hyperplasia, systematic grading of, 13312
gills, water flow and gas exchange, rainbow trout, 13241
gonadal biopsy, evaluation from tag returns, striped bass, 13256
internal development of young tunas, 13252
intestine, carp, vitamin B_{12} production by microbes, 13225
kidney, hemosiderin re erythropoiesis in blue gourami, 13118
liver,
extraction of nucleic acids with phenol, 13208
hemosiderin re erythropoiesis in blue gourami, 13118
protein-deficiency urocanase, carp, 13272
meristic differences, Arctic char of Sagavanirktok Drainage, Alaska, 13129
morphology,
and variability of Arctic char, Kamchatka River, USSR, 13462
of lake trout alevins, Lake Heney, Quebec, 13377
mouth size of fish larvae, studies, 13222

Anatomy, cont.
muscle,
amino acid changes due to starvation, 13141
carp,
ATP-sensitivity of actomyosin and myosin, 13219
preparation of actomyosin from, 13216
preparation of myosin from, 13214
superprecipitation of actomyosin, 13228
extraction of nucleic acids with phenol, 13208
fish-,
determination of nucleotides, 13229
TMAO, TMA and DMA contents, 13231
protein extracts from elution patterns, Japanese fishes, 13224
pancreas, ultrastructure of islets in carp with diabetes, 13258
pineal organ,
demonstration and function of melatonin in chinook, 13404
teleost-, 5-hydroxytryptamine in, 13408
pituitary,
gland of goby re reproductive cycle, 13133
study in sturgeon and paddlefish, re growth hormone, 13415
retinae of teleosts, organization of cone cells, 13392
sexing adult largemouth bass externally, 13302
skin, surface-active agents for removal, 13230
spleen, hemosiderin re erythropoiesis in blue gourami, 13118
testes,
guppy, sterilization by parathion, 13402
hydroxysteroid dehydrogenases, mummichog, 13407
protamines and synthesis during development, trout, 13243
steroidogenesis in, northern pike, 13405
weights in tilapia before and after spawning, 13247
tubercles, nuptial, on female quillback, 13174

Bacteriology,
Aeromonas, re carp swimbladder inflammation, 13357
Ceratomyxa shasta, eradication from water by UV and chlorine, 13301
Chondrococcus columnaris,
characteristics and pathogenicity re pond-cultured eel, 13211
re gill disease in pond-cultured eels, 13269
Lactobacillus leichmannii, re vitamin B_{12} production in carp intestine, 13225
pseudomonad,
from rainbow trout lesions, proteinase properties, 13395
proteolytic-, morphology, from skin lesions of trout, 13158
Pseudomonas, re carp swimbladder inflammation, 13357
Vibrio anguillarum, re red disease of eel in German Bight, 13184

Behavior,
aggression and nest-building of stickleback re food, 13350
avoidance reactions of fish, 13376
feeding,
mechanics of, in various teleosts, 13374
newly-stocked rainbow trout, re invertebrates in stream drift, 13351
prespawning-, of sunfishes, environmental factors, 13261
schooling, fish-, methodological principles for study, 13459
spawning habits and fecundity of Arctic grayling, 13294
swimming-,
chum salmon off Kamchatka, 13206
effect of thyroxine on cod, 13348

Benthos,
burrowing, tool for collecting, 13437
differences above and below impoundment, 13116
effect of coho spawning on, Platte River, Michigan, 13122
Lake Superior, re water quality and trophic condition, 13246
sampler, quantitative-, artificial-substrate, 13251
supply for fishes, re flow and pollution in Dnieper Reservoir, USSR, 13145
Washington Coast, species composition and structure of infauna communities, 13354

Bibliography,
reclamation of waters, FAO review, 13130
Sacramento River Chinook Salmon Disease, 13367
Stizostedion species of North America, 13287

Biocides,
fungicides, phenylmercuric hydroxide, effects of short exposure of roach, 13185
herbicides,
aquathol, toxicity to striped bass fingerlings, 13297
casoron, toxicity to striped bass fingerlings, 13297
copper sulfate as algicide and fish medication, 13195
effects on water and inhabitants, 13368
paraquat, effect on bluegill in farm pond, 13296
insecticides,
DDT,
DDE and DDD,
effects of salinity on uptake by fish, 13371
residues in Saskatchewan River fish, re blackfly control, 13125
food chain model for kinetics in freshwater marsh, 13263
in,
rainbow trout of three New Zealand lakes, 13428
winter flounder, Weweantic River estuary, 13353
interactions with other insecticides, re residues in trout, 13378
residues in,
Canadian Atlantic fishes, 13120
estuarine fauna, significance, 13421
dicapthon, and LAS re toxicity to fathead minnow, 13372
dieldrin,
in,
rainbow trout of three New Zealand lakes, 13428
winter flounder, Weweantic River estuary, 13353
interactions with other insecticides, re residues in trout, 13378
endrin,
absorption by bluegill, 13472
chronic poisoning in goldfish, 13342
EPN, and LAS re toxicity to fathead minnow, 13372
guthion, and LAS re toxicity to fathead minnow, 13372
heptachlor in,
rainbow trout of three New Zealand lakes, 13428
winter flounder, Weweantic River estuary, 13353
lindane,
in rainbow trout of three New Zealand lakes, 13428
toxicity to striped bass fingerlings, 13297
malathion,
chronic toxicity to bluegill, 13398
toxicity to striped bass fingerlings, 13297
methoxychlor, interactions with other insecticides, re residues in trout, 13378
methyl parathion, and LAS re toxicity to fathead minnow, 13372

Biocides, cont.
insecticides, cont.
parathion,
and LAS re toxicity to fathead minnow, 13372
sterilization of guppy testes, 13402
resistant fish, possible selective mechanisms in development, 13366
ronnel, and LAS re toxicity to fathead minnow, 13372
sumithion, effects of aerial spraying on juvenile salmonids, 13373
trichloronat, and LAS re toxicity to fathead minnow, 13372
trithion, and LAS re toxicity to fathead minnow, 13372
pesticides,
Bayluscide, toxicity to striped bass fingerlings, 13297
Co-ral, toxicity to striped bass fingerlings, 13297
pentachlorophenol,
determination in organic tissues and water, 13399
influence on coho fatty acids, 13427
sensitivity in three generations of sheepshead minnows, 13385
toxic substances demonstrated using Lebistes reticulatus, 13190
piscicides,
antimycin, effects of physical and chemical conditions on detoxification, 13170
reclamation of waters, FAO review, 13130
toxaphene, gas-chromatographic analysis in waters, fish, sediments, 13400
poisons,
chlorine for disinfecting water containing Ceratomyxa shasta, 13301
mercury,
compounds, conversion to methylmercury in nature, 13422
contamination of environment in Sweden, 13423
detection in fish killed by pollution, 13218
in the marine environment, 13420
methyl mercury, pathways into fish, 13364
metoxyethylmercuric chloride, toxicity to Oryzias latipes, 13232
PMA, toxicity to Oryzias latipes, 13232

Chemical factors,
cadmium, physiological responses of mummichog, 13338
carbon monoxide, exposure of trout, re oxygen uptake, transport, 13240
mercury, determination of submicrogram quantities in lake water, 13203
methylmercury, pathways into fish, 13364
nitrogen supersaturation re thermal tolerance of juvenile salmon, 13193
oxygen,
diel, prediction of minimum in ponds with macrophytes, 13299
low-, response of respiratory pumps in rainbow trout, 13446
re winterkill survival variability in yellow perch, 13426
pH, effect on reactions of O_2 and CO with carp hemoglobin, 13452
phosphorus, uptake from water by tilapia, 13165
re antimycin detoxification, 13170
salinity re,
culture of Dungeness crab larvae in laboratory, 13380
uptake of DDT, DDE and DDD by fish, 13371
water quality and trophic condition of Lake Superior, 13246

Chemicals,
cadmium, physiological responses of mummichog, 13338
carbon monoxide, exposure of trout, re oxygen uptake, transport, 13240
chlorine, for disinfecting water containing Ceratomyxa shasta, 13301
copper sulfate as fish medication and algicide, 13195
formaldehyde, identification in aquatic animals by chromatography, 13217
LAS,
factors affecting toxicity to bluegill, 13169
for chemical skinning of fish, 13230

Chemicals, cont.
methylmercury, pathways into fish, 13364
metoxyethylmercuric chloride, toxicity to Oryzias latipes, 13232
nitrilotriacetate, acute toxicity to fry and crustaceans, 13442
PEFA, for chemical skinning of fish, 13230
phenol, for extracting nucleic acid from fish muscle, liver, 13208
phenylmercuric acetate, toxicity to Oryzias latipes, 13232
polychlorinated biphenyls, solubilized in water by surfactants for toxicity studies, 13390
SE, for chemical skinning of fish, 13230

Culture,
acidification of aquarium water re sand filtration, 13207
aquaculture bulletin, FAO, 13260
bait fishes in United States, 13356
bass, striped, biology of eggs, larvae, young, re planting in USSR, 13465
biostimulators: lysine and terramycin, re growth and condition of market fish, 13361
cage-, channel catfish, Auburn Univ. Extension Service, 13119
carp,
biotin requirement, 13204, 13266
effects of α-tocopherol deficiency, 13235
young, α-tocopherol requirement, 13279
catfish, Auburn Univ. Extension Service, 13136
conversion efficiency formulae, 13212
use in breeding fishes, 13213
copper sulfate as fish medication and algicide, 13195
disinfection of water with UV and chlorine, re Ceratomyxa shasta, 13301
Dungeness crab larvae in laboratory, 13380
ectoparasite control with masoten, 13183
eel, thiamine deficiency symptoms, 13273
elvers in aquaria, 13434
fish food distributor for hatchery raceways, 13471
gill hyperplasia, systematic grading of, 13312
immunization against furunculosis, testing antigenicity of vaccine, 13298
laboratory-, of desert pupfish, 13161
methods, Huet's treatise, 13469
pollution potential of salmonid hatcheries, 13470
salmon,
chinook, fingerlings, temperature effects on growth, form and hematology, 13295
chum and pink, to increase Sakhalin stocks, 13466
seawater system, open-, with salinity and temperature control, 13298
sexing adult largemouth bass externally, 13302
spawning, carp, laboratory technique for, 13300
sterilizer, water-, for egg incubators, 13468
transport, fish-, irrigation pipe for, 13309
trout, growth-control technique, 13310

Diet,
α-tocopherol
deficiency, effects on carp, 13235
requirement of young carp, 13279
biostimulators: lysine and terramycin, re growth and condition of market fish, 13361
biotin requirement of carp, 13266
medicated, phenosal in pellets for cestode control, 13363
nutritive value of free amino acids, young carp, 13223
protein, utilization by young carp, 13220
thiamine deficiency symptoms in eel, 13273

Disease,
Ceratomyxa shasta, eradication from water by UV and chlorine, 13301
columnaris, bacterium from pond-cultured eels, 13211
control in eggs and fishes with UV, 13146
deficiency of α-tocopherol, effects on carp, 13235
diabetes mellitus, ultrastructure of pancreatic islets, carp, 13258
fungus epizootics in flounder caused by Ichthyophonus, 13438
furunculosis,
in nonsalmonids, 13339
testing vaccine antigenicity for immunization, 13298
gill-, re Chondrococcus columnaris in pond-cultured eels, 13269
hyperplasia, gill, systematic grading of, 13312
neoplasm, hematopoietic, suggesting leukemia, in cutthroat trout, 13127
papilloma in European eel, re tumorgenesis, 13182
prophylactic measures in stocking new fishes in waters, 13381
pseudomonad,
from rainbow trout lesions, proteinase properties, 13395
proteolytic-, from skin lesions of trout, morphology, 13158
red-, of European eel in German Bight, 13184
Sacramento River Chinook-, specifics and control, 13367
sockeye salmon virus, species specificity and cytopathology in salmonid cells, 13382
swimbladder inflammation of carp, etiology and pathogenesis, 13357

Distribution,
albacore in Indian and Atlantic Oceans, 13383
Anguilla recorded from California, 13329
billfishes in Atlantic Ocean, 13387
checklist of fishes in Buttonwood Canal, Florida, 13257
cobia, prejuvenile and juvenile, Gulf of Mexico, 13250
crappie, white, vertical, in Lake Texoma, 13291
flounder, yellowtail, Newfoundland area, 13345
freshwater fishes of northwestern Canada and Alaska, 13330
larvae, fish-, kinds and abundance in eastern tropical Pacific, 13159
macrozoo-, and small nekton, off Vancouver Island and Washington, 1963, 13333
marine fishes of Virginia's eastern shore, 13238
range, altitudinal extension, fathead minnow, 13253
salmon, chinook, occurrence in Kings River, California, 13321
snook in North Carolina waters, 13262
tunas and marlins in Atlantic Ocean, 13389
zooplankton in Canton Reservoir, Oklahoma, 13264

Drugs,
acriflavin, toxicity to striped bass fingerlings, 13297
chloralhydrate, anesthetic effects on tilapia, 13255
chlorbutol, anesthetic effects on tilapia, 13255
copper sulfate as fish medication and algicide, 13195
cupravit, inhibition of enzyme activity in trout, whitefish, 13439
formaldehyde, identification in aquatic animals by chromatography, 13217
gonadotrophin, human-, chorionic-, injection re prespawning behavior of sunfishes, 13261
gonadtropin, salmon-, spermiation of goldfish as bioassay for, 13396
lysine, as biostimulator, re growth and condition of market fish, 13361
malachite green,
inhibition of enzyme activity in trout, whitefish, 13439
oxalate, toxicity to striped bass fingerlings, 13297
masoten, to control fish ectoparasites, 13183
MS-222,
anesthetic effects on tilapia, 13255
sampling of fish muscle for residues, 13128

Drugs, cont.
phenosal, in medicated feed for cestode control, 13363
propoxate, anesthetic effects on tilapia, 13255
propylene phenoxetol, anesthetic effects on tilapia, 13255
quinaldine,
anesthetic effects on tilapia, 13255
sampling of fish muscle for residues, 13128
terramycin,
as biostimulator, re growth and condition of market fish, 13361
concentrate, toxicity to striped bass fingerlings, 13297
urethane, anesthetic effects on tilapia, 13255
vaccine, for immunization against furunculosis, antigenicity testing, 13298

Ecology,
anchovy, northern, larvae, food density re growth and survival, 13447
bass, striped, biology of eggs, larvae, young, re planting in USSR, 13465
carrying capacity of some No. California streams for juvenile salmonids, 13326
ecosystem,
Connecticut River-, effect of thermal pollution, 13425
marine-, chlorinated hydrocarbons in, 13419
of Lake Dal'neye, analog model of, 13454
fishes,
associated with drifting kelp, southern California, 13317
Buttonwood Canal, Florida, 13257
food of juvenile herring, seasonal variations in, Maine, 13191
grayling, Baikal-, black-, young, 13456
habitat selection in fourspine stickleback, 13201
heated water in cooling reservoirs, beneficial uses, 13424
limiting factors re fish abundance, 13142
mercury,
compounds, conversion to methylmercury in nature, 13422
contamination of environment in Sweden, 13423
in the marine environment, 13420
model, food-chain-, for DDT kinetics in marsh, 13263
re thermal pollution, 13168
schooling, fish-, methodological principles for study, 13459
sedimentation of salmonid spawning beds, effects of logging, 13316

Electricity,
alternating current, effect on fishes and invertebrates, 13144
electrode chamber for recording respiratory movements, 13172
electroshocker for young shad collection at hydroelectric intakes, 13306

Embryology,
fishes, and theory of individual development of organisms, 13460
grunion, effect of temperature on development, 13327
salmon hybrids, sex-related parental influence on early development, 13340
sturgeons, metabolism in early life stages, 13139
trout, rainbow, carbohydrate in egg protein, 13386

Equipment,
apparatus for rapid volumetric analysis of food of fishes, 13163
aquarium, acidification of water re sand filtration, 13207
barrier, plastic-, for spot treatment of aquatic vegetation, 13304
bathythermograph data plotted on computer printer, 13124
centrifuge, for separating food organisms from shad gut contents, 13244
chromatography, thin-layer, for identification of formaldehyde in aquatic animals, 13217
computer printer, for plotting bathythermograph data, 13124

Equipment, cont.
concave gradient elution for determination of fish muscle nucleotides, 13229
counter, sonar-, fish-, 13155
device for removing fish embryo from egg, 13123
electrode chamber for recording respiratory movements, 13172
electroshocker, for young shad collection at hydroelectric intakes, 13306
food distributor for hatchery raceways, 13471
gas-chromatographic-, for toxaphene determination in water, fish, sediments, 13400
irrigation pipe for fish transport, 13309
light-control apparatus for experimental environments, 13215
mercury-determination-, submicrogram quantities in lake waters, 13203
pentachlorophenol-determination-, re organic tissues and water, 13399
photoelectric method for recording melanophore responses, 13375
reflectance method for measuring melanophore responses, 13370
respirometer, fish-, 13303
sampler,
free-vehicle-, bottom-water-, 13436
quantitative-, artificial-substrate-, for benthos, 13251
screens, traveling, for diversion and collection of juvenile fish, 13365
seawater system, open-, with salinity and temperature control, 13293
sterilizer, bactericidal-, water-, for fish egg incubators, 13468
structures, artificial-, for attracting coastal pelagic fishes, 13181
suction device, portable-, underwater-, for fish egg and larvae collection, 13305
surface-active agents for removing fish skin, 13230
tag, transponding-, acoustic-, tracked with sonar, 13328
tagging gun for marking flatfish, 13443
tool for collecting burrowing aquatic animals, 13437

Estuaries,
Buttonwood Canal, Florida, checklist of fishes, 13257
Casco Bay, Maine, heat budget re circulation, 13344
Weweantic River-, Massachusetts, insecticide residues in winter flounder, 13353

Farm ponds,
paraquat, effect on bluegill, Colorado, 13296

Food habits,
analysis of food of fishes, rapid volumetric method, 13163
bass, striped, young-of-the-year, Canton Reservoir, Oklahoma, 13286
carp, silver, daily food consumption, digestion rate, 13147
larvae of Black Sea fishes, survival re food supply, 13134
perch, European, in drawdown zone, Kuibyshev Reservoir, USSR, 13138
selection of food by sardine and anchovy larvae, laboratory study, 13432
shad, food organism isolation from gut content by centrifuge, 13244
sunfishes, 3-, and hybrids, in 3 Minnesota lakes, 13199
tilapia larvae, transition to active feeding, 13148
trout,
lake-, alevins in Lake Heney, Quebec, 13377
rainbow, feeding re abundance of drifting invertebrates in stream, 13351

Genetics,
albinism in lampreys, upper Great Lakes, 13254
control in lakeward migrations of cutthroat fry, 13175
electrophoretic studies on proteins of 4 species of Tilapia, 13337
hybrid success, intergeneric-, egg size factor, centrarchids, 13173
hybridization, salmon, sex-related parental influence on early development, 13340
malate dehydrogenase, supernatant-, multiple forms in salmonids, 13453

Genetics, cont.
polymorphism,
hemoglobin, in sea- and landlocked Atlantic salmon, 13151
transferrin, in coho salmon, 13352
reproduction isolation between 2 sympatric daces, Manitoba, 13334
selective mechanisms in development of insecticide resistant fish, 13366
trout,rainbow, 4 strains from Beardsley Reservoir, California, comparison, 13315

Habitat improvement,
destratification, pneumatic-, of density layers, 13283
reclamation of waters with piscicides, FAO review, 13130
spawning grounds, artificial-, for sturgeon, 13132
spot treatment of aquatic vegetation, plastic barrier for, 13304
structures, artificial-, for attracting coastal pelagic fishes, 13181

Harvest,
bass, striped, California, party boat fishery, 1960-1968, 13323
creel survey, reservoirs, recommended method of reporting, 13457
exploited fish populations, calculation of sustainable yield, 13388
perch, Pacific Ocean-, 13290
techniques and intensity required, 13282
sailfish sport fishery, Kenya, 1958-1968, 13259
salmon,
by,
gillnet, mesh restrictions to minimize steelhead catch, 13281
Washington troll fleet in 1967, 13280
coho, size, age and maturity in Washington troll fishery, 13285
linear-programming solution to management, 13160
seatrout, 18-year trawl captures, South Carolina, 13360
trout, rainbow, 4 strains from Beardsley Reservoir, California, 13315
tunas and marlins in Atlantic Ocean, 13389

Identification,
Brachiella lageniformis on hake in Canadian Pacific, taxonomic significance, 13336
char, Arctic,
meristic differences, Sagavanirktok River drainage, Alaska, 13129
morphology and variability of, Kamchatka River, USSR, 13462
checklist of fishes in Buttonwood Canal, Florida, 13257
clupeid larvae, differences, River Elbe, Germany, 13433
cobia, prejuvenile and juvenile, Gulf of Mexico, 13250
Etheostoma barbouri, new darter from Green River basin, 13248
food organisms separated from shad foregut contents by centrifuge, 13244
formaldehyde in aquatic animals, by chromatography, 13217
freshwater fishes of northwestern Canada and Alaska, 13330
mercury, detection in fish killed by pollution, 13218
Notropis gibbsi, new cyprinid from Tallapoosa River system, 13249
perch, Pacific Ocean-, 13290
phylogeny re immunoglobins of giant grouper, 13242
Recent fishes, estimates of number of species, 13324
salmon,
Atlantic, sea- and landlocked-, hemoglobin polymorphism, 13151
Caspian, re protein composition of blood serum, 13140
coho, by transferrin polymorphism, 13352
scorpaenids, northeastern Pacific, 13343
Tilapia, 4 species, electrophoretic studies of proteins, 13337
tunas, young, internal development, 13252

In vitro,
cell lines, salmonid and mammalian, CO_2 requirements, 13289

In vitro, cont.
steroidogenesis in testicular tissue of northern pike, 13405

Lake,
Baikal, age-related changes in grayling blood, 13143
Dal'neye, analog model of ecosystem of, 13454
Francis Case, changes in fish populations, 1952-68, 13331
Great Lakes, upper, albinism in lampreys, 13254
Heney, Quebec, capture, morphology and food of lake trout alevins, 13377
Il'men, USSR, reconstruction of fish growth using bream, 13149
Jennings, California, introduction of blue catfish, 13319
Michigan, alewife predation on zooplankton, effects, 13430
Munsel, Oregon, evaluation of cutthroat stocking, 13179
reservoir,
Arizona reservoirs, central-, maturity and fecundity of threadfin shad, 13180
Beardsley, California, harvest of 4 strains of rainbow trout, 13315
Bratskoe, USSR, results of acclimatization of fishes, 13355
Canton, Oklahoma,
age and growth of walleye, 13292
distribution and abundance of zooplankton, 13264
fish population of stilling basin, 13314
fish samples and year-class strength, 1965-67, 13318
food habits of young striped bass, 13286
creel survey, recommended reporting method, 13457
Dnieper, flow and pollution re food supply of benthic-feeding fishes, 13145
fisheries management re power engineering, 13461
Kremenchug, USSR, metabolic rate in young commercial fishes, 13455
Kuibyshev, feeding of perch in drawdown zone, 13138
Rybinsk, condition and fatness of blue bream, 13137
Wilson, Kansas, impoundment biology, 13358
Superior,
population biology of lake trout before 1950, 13121
water quality and trophic condition, 13246
Tahoe, kokanee salmon production and life history, 13325
Texoma, vertical distribution of white crappie, 13291
Trapper's, Colorado, size limit regulation re trout fishery, 13178
trout-, studies, Colorado, ^{137}Cs data, 13189
Washington, assessing juvenile sockeye stock by echo integration, 13188

Life history,
fishes, Buttonwood Canal, Florida, 13257
perch, Pacific Ocean-, 13290
sculpin, shorthorn, in Newfoundland waters, 13335
shad, threadfin, maturity and fecundity in central Arizona reservoirs, 13180
trout, brown, of Karelian isthmus, 13463

Limnology,
benthos, differences above and below impoundment, 13116
destratification, pneumatic-, of density layers, 13283
fish populations, differences above and below impoundment, 13117
impoundment of biology of Wilson Reservoir, Kansas, 13358
mercury in lake waters, determination of submicrogram quantities, 13203
methyl mercury, pathways into fish, 13364
oligotrophic pond, nutrient limiting factors, 13131
oxygen, diel, prediction of minimum in ponds with macrophytes, 13299
temperature, plotting bethythermograph data on computer printer, 13124
trout lake studies, Colorado, ^{137}Cs data, 13189
water quality and trophic condition of Lake Superior, 13246
winterkill survival variability in yellow perch, 13426

Management,
cooling reservoirs, beneficial uses of heated water, 13424
destratification, pneumatic-, of density layers, 13283
fisheries-, in impoundments, re power engineering, 13461
juvenile fish, diversion and collection with travelling screen, 13365
mesh restrictions to minimize steelhead catch in gillnet salmon fishery, 13281
reclamation of waters with piscicides, FAO review, 13130
salmon,
Atlantic, Salmon Research Trust of Ireland, Inc., 13458
coho, size, age and maturity in Washington troll fishery, 13285
linear-programming solution to, 13160
shad, juvenile, electroshocker for collection at hydroelectric intakes, 13306
size limit regulation, effect on trout fishery, Colorado lake, 13178
structures, artificial-, for attracting coastal pelagic fishes, 13181
trout, rainbow, comparison of four strains, Beardsley Reservoir, California, 13315

Marking,
gun, tagging-, for marking flatfish, 13443
tag, transponding-, acoustic-, tracked with sonar, 13328

Mathematics,
analog of ecosystem of Lake Dal'neye, 13454
ATP-sensitivity of actomysin and myosin from carp muscle, formula definition, 13219
biostatistical method of A. N. Derzhavin, analysis, 13157, 13362
calculation of sustainable yield, exploited fish populations, 13388
creel census data, actual vs. reported fishing times as factor, 13311
fat content re wet and dry weight of fishes, Azov-Black Sea basin, 13150
food conversion, effects of temperature on coefficients β', β and γ, 13275
formula for change in toxicity of mercurials with growth of Oryzias latipes, 13232
formula for efficiency of food conversion, 13212
use in breeding fishes, 13213
linear-programming solution to salmon management, 13160
model, food-chain-, for DDT kinetics in marsh, 13263
parameters of fish populations, evaluation based on catch and effort data, 13384

Migration and movement,
albacore in Indian and Atlantic Oceans, 13383
salmon, Atlantic,
changes,
in corpuscle of Stannius, 13403
Scottish river system, 13154
young in White Sea rivers, 13135
sole, petrale-, tagged in deep water off Washington coast, 13284
trout, cutthroat,
fry, lakeward, genetic control in, 13175
Yellowstone Park creeks, 13176
tunas and marlins in Atlantic Ocean, 13389

Parasites,
Apocreadium manteri, from spot, Gulf of Mexico, 13409
Brachiella lageniformis on gills of hake in Canadian Pacific, 13336
Ceratomyxa aggregata in halfbeak, 13187
cestode infestation, intestinal-, phenosal in feed for control, 13363
copper sulfate against, aquarium fishes, 13195
Discocotyle sagittata, description of oncomiracidium, 13369
ecto-, of fish, masoten for control, 13183
endohelminths, effects of season, host age and sex on, white sucker, 13417

Parasites, cont.
Fistulicola plicatus on Atlantic swordfish, 13115
helminths of northern pike, Labrador, 13411
Ichthyophonus, fungus agent of epizootics in yellowtail flounder, 13438
Lasiotocus trachinoti, from pompano, Florida, 13410
Lecithaster leiostomi, from spot, Gulf of Mexico, 13409
Lernaea cyprinacea, transfer of larvae from goldfish to frog, 13418
metazoan, of 2-spine stickleback in Newfoundland, 13202
Myxidium,
sp. in ballyhoo, 13187
sphaericum in timucu, 13187
Myxosoma cephalis in striped mullet, 13187
Pomphorhynchus laevis, precipitin production by chub to, 13412
prophylactic measures in stocking new fishes in waters, 13381
Proteocephalus longicollis, inhibition of trypsin and α-amylase, 13441
Tristoma,
coccineum on Atlantic swordfish, 13115
integrum on Atlantic swordfish, 13115

Physical factors,
heat budget re circulation, Casco Bay, Maine, 13344
photoperiod, re prespawning behavior of sunfishes, 13261
re detoxification of antimycin, 13170
temperature,
effects on growth, form and hematology, chinook fingerlings, 13295
plotting bathythermograph data on computer printer, 13124
re,
culture of Dungeness crab larvae in laboratory, 13380
development of grunion, 13327
lactic and pyruvic acid changes during hypoxia, bluegill, 13322
prespawning behavior of sunfishes, 13261
responses of bullhead in gradual hypoxia, 13313
sensitive neurons in brain of brook trout, 13451
tolerance and thyroid activity of white perch, 13167
thermal,
pollution, resistance of rainbow trout to variations, 13401
tolerance of juvenile salmon re nitrogen supersaturation, 13193
water quality and trophic condition of Lake Superior, 13246

Physiology,
acclimation, thermal-, re variation of trout liver citrate synthases, 13449
actomyosin,
-ATPase activation by lecithin, 13234
preparation from carp muscle, 13216
superprecipitation from carp muscle, 13228
alkylpolyglycol ethers, effect on fish, 13192
amino acids, free, nutritive value, young carp, 13223
anti-dinitrophenyl antibody of gray snapper, 13413
antigenic specificity of blood groups that differentiate catfish populations, 13414
α-tocopherol,
deficiency, effects on carp, 13235
requirement of young carp, 13279
ATP-sensitivity of actomyosin and myosin from carp muscle, 13219
biological changes in capelin from overwintering to spawning condition, 13341
biotin requirement of carp, 13204
C^{14} cortisol injected into salmon, radioactivity changes re sexual maturation, 13394
calcium content of chinook at stages of life cycle, 13153
carbohydrate in protein of rainbow trout egg, 13386

Physiology, cont.
carotenoids in,
Benibuna and goldfish, 13270
sea breams, 13265
cell lines, CO_2 requirements, salmonids and mammalian, 13289
chitinolytic activities in digestion of some fishes, 13271
chloralhydrate, effects as anesthetic on tilapia, 13255
chlorbutol, effects as anesthetic on tilapia, 13255
circulatory-system parameters, trout, carp, eel, 13276
color change, effect of hypophysectomy, mummichog, 13236
cone cells, organization in retinae of teleosts, 13392
corpuscle of Stannius, changes during spawning migration, Atlantic salmon, 13403
cortisol secretion, effect of sexual maturity and gonadectomy on, sockeye, 13346
cortisone secretion, dynamics during sexual maturation and after gonadectomy, sockeye, 13347
^{137}Cs, residues in trout, Colorado lakes, 13189
cytopathology and species specificity of sockeye virus in salmonid cell lines, 13382
DDT, DDE and DDD uptake by fish, effects of salinity, 13371
digestion rate re food consumption of silver carp, 13147
electric current, alternating-, effect on fishes and invertebrates, 13144
endrin,
absorption by bluegill, 13472
poisoning, chronic-, in goldfish, 13342
enzyme activity re pH, temperature, water, whitefish and rainbow trout, 13439
evacuation rate of salmon alevins from whitefish stomach, 13126
fat content re wet and dry weight of fishes, Azov-Black Sea basin, 13150
fatty acid,
-amide in carp, sea bream, 13268
influence of pentachlorophenol on, coho, 13427
FDPase, properties from deep and shallow-water fishes, 13431
fecundity,
of Arctic grayling, 13294
regularities of change in, on example of sprats, 13391
feeding, mechanics of, in various teleosts, 13374
food,
conversion, effects of temperature on coefficients α', α and γ, 13275
uptake and conversion efficiency, yellowtail, 13274
formaldehyde, identification in aquatic animals by chromatography, 13217
gonad maturation and hormone-induced spawning, Gulf croaker, 13162
gonadal biopsy, evaluation from tag returns, striped bass, 13256
grayling, Baikal-, black-, young, 13456
growth hormone re pituitary of sturgeon, paddlefish, 13415
hematology,
chinook fingerlings, effect of temperature, 13295
of herbivorous carps of East Asia, 13435
hemoglobin, reactions with O_2 and CO re pH, carp, 13452
hemosiderin re erythropoiesis in blue gourami, 13118
histochemistry of mucus on eel epidermis, 13209
hyaluronidase, gastric-, mechanism of action in fish, 13221
hydroxysteroid dehydrogenases in mummichog testis, 13407
5-hydroxytryptamine in teleost pineal organs, 13408
hypothalamus, monoamines in, lampreys and ice-goby, 13210
hypoxia,
gradual, responses of bullhead at two temperatures, 13313
lactic and pyruvic acid changes re temperature, bluegill, 13322
immunization against furunculosis, antigenicity testing of vaccine, 13298
insecticides, interactions affecting residue storage in rainbow trout, 13378

Physiology, cont.
lactate acidosis as cause of mortality in captured sharks, 13267
liver, protein-deficiency urocanase, carp, 13272
magnesium content of chinook at stages of life cycle, 13153
malate dehydrogenase, supernatant-, multiple forms in salmonids, 13453
maturation and fecundity of threadfin shad in central Arizona, 13180
melanophore responses,
in teleosts, continuous recording, 13375
reflectance method for measurement, 13370
melatonin, demonstration and function in chinook, 13404
mercury, detection in fish killed by pollution, 13218
metabolic rate in young fishes, Kremenchug Reservoir, USSR, 13455
metabolism of sturgeons in early life stages, 13139
MS-222, effects as anesthetic on tilapia, 13255
muscle, fish,
determination of nucleotides, 13229
TMAO, TMA and DMA contents, 13231
myosin, preparation from carp muscle, 13214
neurohypophyseal hormones, isolation and amino-acid sequence, chinook, 13416
neurons, temperature-sensitive-, in brain of brook trout, 13451
nucleic acids, extraction from fish muscle and liver with phenol, 13208
oils and,
fats of fish, properties, 13440
lipids, composition and biochemistry of, from marine and freshwater fishes, 13444
osmoregulation and endocrine glands of teleosts, 13278
oxygen uptake and transport by rainbow trout exposed to CO, 13240
pancreas, ultrastructure of islets in diabetic carp, 13258
pentachlorophenol, determination in organic tissues and water, 13399
permeability to water of plains killifish, effects of prolactin and divalent ions, 13448
phenylmercuric hydroxide, effects of brief exposure in European roach, 13185
phosphorus uptake from water by tilapia, 13165
pikeperch females, and biochemistry, Don River, USSR, 13467
pituitary gland of goby re reproductive cycle, 13133
potassium content of chinook at stages of life cycle, 13153
precipitin production by chub to Pomphorhynchus laevis, 13412
propoxate, effects as anesthetic on tilapia, 13255
propylene phenoxetol, effects as anesthetic on tilapia, 13255
protein,
dietary-, utilization by young carp, 13220
electrophoretic studies in four species of Tilapia, 13337
extracts from fish muscle, elution patterns, Japanese fishes, 13224
utilization re starvation in bluegill, 13171
quinaldine, effects as anesthetic on tilapia, 13255
radiothyroxine, biliary excretion by brook trout, 13429
reflectors, nitrogenous-compound-, in fishes, 13332
residues,
DDT,
DDE and DDD in Saskatchewan River fish, re blackfly control, 13125
in Canadian Atlantic fishes, 13120
MS-222, sampling fish muscle for, 13128
quinaldine, sampling fish muscle for, 13128
respiration,
Clarias lazera, survivability without air breathing, 13239
considered from arterio-venous oxygen difference, 13233
gas exchange and water flow at gills of rainbow trout, 13241
respiratory,
movements, electrode chamber for recording, 13172
pumps, response to hypoxia in rainbow trout, 13446

Physiology, cont.
responses of mummichog to cadmium, 13338
RNA-DNA ratios as indicators of recent growth rates of a fish, 13349
serology,
blood,
amino acid changes due to starvation, 13141
of Baikal grayling, age-related changes, 13143
blue-green serum pigment of eel, lipid moiety, 13277
hemoglobin polymorphism in sea- and landlocked Atlantic salmon, 13151
immunoglobulins of giant grouper, phylogeny, 13242
osmotic pressure changes, serum protein pattern,
rockfish, 13226
yellowtail, 13227
protein composition of blood serum of Caspian salmon, re taxonomy, 13140
serum,
antibodies, effects of storage, goldfish, 13308
glucose, osmoregulatory role in mummichog at near-freezing, 13166
sexual maturity of shorthorn sculpin in Newfoundland waters, 13335
sodium content of chinook at stages of life cycle, 13153
spermiation of goldfish as bioassay for salmon gonadotropin, 13396
starvation, changes in amino acid composition of muscles, blood, 13141
steroidogenesis in testis of northern pike, 13405
temperature, brain- and muscle-, in oceanic and captive tuna, 13152
testis,
guppy, sterilization by parathion, 13402
protamines and synthesis during development, trout, 13243
thiamine deficiency symptoms in eel, 13273
thyroid activity of white perch re temperature tolerance, 13167
thyroxine, effect on swimming of cod, 13348
toxaphene in fish, analysis by gas chromatography, 13400
transferrin polymorphism in coho salmon, 13352
trypsin and α-amylase inhibition by Proteocephalus longicollis, 13441
urethane, effects as anesthetic on tilapia, 13255
uricolytic enzymes in cod sperm, 13393
urophysial substance, effect on rainbow trout urinary bladder, 13406
vitamin B_{12} production by microbes in carp intestine, 13225

Plankton,
diatoms, algae, in upper Potomac River, re power-plant discharge, 13288
macrozoo-, and small nekton, off Vancouver Island and Washington, 1963, 13333
zoo-,
distribution and abundance, Canton Reservoir, Oklahoma, 13264
effects of predation by alewife, Lake Michigan, 13430

Pollution,
alkylpolyglycol ethers, effect on fish, 13192
avoidance reactions of fish, 13376
cadmium, physiological responses of mummichog, 13338
chlorinated hydrocarbons in marine ecosystems, 13419
^{137}Cs, Colorado trout lake studies, 13189
DDT,
DDE, DDD, effects of salinity on uptake by fish, 13371
food chain model for kinetics in freshwater marsh, 13263
in winter flounder, Weweantic River estuary, Massachusetts, 13353
residues in estuarine fauna, significance, 13421
detergents, inhibition of enzyme activity in rainbow trout, whitefish, 13439
dieldrin, in winter flounder, Weweantic River estuary, Massachusetts, 13353
endrin, absorption by bluegill, 13472
English rivers, water quality and absence of fish, 13397

Pollution, cont.
fish kills, 1969, United States, 13186
heptachlor, in winter flounder, Weweantic River Estuary, Massachusetts, 13353
herbicides, effects on water and inhabitants, 13368
industrial, re food supply of benthic-feeding fishes, Dnieper Reservoir, USSR, 13145
insecticide-resistant fish, possible selective mechanisms in development, 13366
LAS,
factors affecting toxicity to bluegill, 13169
re toxicity of pesticides to fathead minnow, 13372
malathion, chronic toxicity to bluegill, 13398
mercury,
compounds, conversion to methyl mercury in nature, 13422
contamination of environment in Sweden, 13423
detection in fish killed by pollution, 13218
determination of submicrogram quantities in lake waters, 13203
methyl mercury, pathways into fish, 13364
metoxyethylmercuric chloride, toxicity to Oryzias latipes, 13232
nitrilotriacetate, acute toxicity to fry and crustaceans, 13442
organics, trace-, toxic effects on fish, 13205
organochlorine insecticides in rainbow trout of three New Zealand lakes, 13428
parathion, sterilization of guppy testes, 13402
pentachlorophenol determination in organic tissues and water, 13399
phenol, inhibition of enzyme activity in rainbow trout, whitefish, 13439
phenylmercuric,
acetate, toxicity to Oryzias latipes, 13232
hydroxide, effects of short exposure of European roach, 13185
polychlorinated biphenyls, solubilized by surfactants for toxicity studies, 13390
potential of salmonid hatcheries, 13470
power-plant discharge, upper Potomac River, re diatoms and algae, 13288
sedimentation of salmonid spawning beds, effects of logging, 13316
sodium halides and gamma radiation, effects on rainbow trout, 13194
sumithion, effects of aerial spraying on juvenile salmonids, 13373
thermal,
analysis, 13168
beneficial uses of heated water in cooling reservoirs, 13424
effect on Connecticut River ecosystem, 13425
resistance of rainbow trout to temperature variation, 13401
toxaphene, analysis in waters, fish, sediments by gas chromatography, 13400
toxic substances demonstrated using Lebistes reticulatus, 13190
water quality of Lake Superior, 13246

Populations,
billfishes in Atlantic Ocean, 13387
biostatistical method of A. N. Derzhavin, 13362
Black Sea food fishes, recruitment, 1965-1968, 13464
changes, Lake Francis Case, 1952-1968, 13331
char, Arctic,
meristic differences, Sagavanirktok River drainage, Alaska, 13129
morphology and variability, Kamchatka River, USSR, 13462
fecundity, regularities of change in, on example of sprats, 13391
fish,
differences above and below impoundment, 13117
exploited-, calculation of sustainable yield, 13388
fishes, Woods Hole, Massachusetts area, numbers and lengths by season, 13198
flounder, yellowtail-, abundance in Newfoundland area, 13345
limiting factors re fish abundance, 13142
nonsalmonids with furunculosis, 13339
northern pike-bluegill-, study, 13177

Populations, cont.
parameters, evaluation based on catch and effort data, 13384
perch, Pacific Ocean-, 13290
salmon, sockeye, juvenile, assessing stock by echo integration, 13188
salmonid-, abundance in Columbia River basin, 13196
species diversity and abundance, methods, 13379
stilling basin-, below Canton Reservoir, Oklahoma, 13314
trout,
brook, in Colorado beaver ponds, 13450
lake, biology in Lake Superior before 1950, 13121
tunas and marlins in Atlantic Ocean, 13389
zooplankton, effects of predation by alewife, Lake Michigan, 13430

Predation,
alewife on zooplankton, effects, Lake Michigan, 13430
sculpins on fall chinook fry from hatcheries, 13197

Production,
bass, striped, party boat fishery, 1960-68, California, 13323
billfishes in Atlantic Ocean, 13387
fish samples and year-class strength, 1965-67, Canton Reservoir, Oklahoma, 13318
limiting factors re fish abundance, 13142
macrozooplankton and small nekton, off Vancouver Island and Washington, 1963, 13333
nutrient limiting factors in oligotrophic pond, 13131
salmonids, juvenile, carrying capacity of some No. California streams, 13326
trophic condition of Lake Superior, 13246
zooplankton abundance in Canton Reservoir, Oklahoma, 13264

Radiobiology,
C^{14} cortisol injected into salmon, radioactivity changes re sexual maturation, 13394
^{137}Cs, Colorado trout lake studies, 13189
echo integration for assessment of juvenile sockeye stock, 13188
gamma radiation and sodium halides, effects on rainbow trout, 13194
radiophosphorus, uptake from water by tilapia, 13165
radiotelemetry re winter gillnetting, ice jigger location, 13307
radiothyroxine, biliary excretion by brook trout, 13429
sonar fish counter, 13155
UV,
for disease control in eggs, fishes, 13146
irradiation to eradicate Ceratomyxa shasta from water, 13301
sterilizer for water of fish egg incubators, 13468

Reproduction,
breeding fishes, use of formulae for efficiency of food conversion, 13213
cycle, re pituitary gland of goby, 13133
fecundity, regularities of change in, on example of sprats, 13391
isolation between two sympatric daces, Manitoba, 13334
pikeperch females, physiology and biochemistry, Don River, USSR, 13467
prespawning behavior of sunfishes, environmental factors, 13261
sexing adult largemouth bass externally, 13302
spawning,
areas of salmonids in Columbia River, 13196
Atlantic salmon, changes in corpuscle of Stannius, 13403
beds, salmonids, effects of logging on sedimentation, 13316
billfishes in Atlantic Ocean, 13387
carp, laboratory technique for, 13300
coho, effect on benthos in Platte River, Michigan, 13122
conditions, Black Sea food fishes, 1965-68, 13464

Reproduction, cont.
spawning, cont.
grounds, artificial-, for sturgeon, 13132
habits and fecundity of Arctic grayling, 13294
hormone-induced-, Gulf croaker, 13162
periods of Caspian gray mullet, 13359
testis weights in tilapia before and after, 13247
yellowtail flounder, Newfoundland area, 13345

Research,
antimycin, effects of physical and chemical conditions on detoxification, 13170
avoidance reactions of fish, 13376
bioassay, chronic-, constant-flow device for, 13245
cell lines, salmonid and mammalian, CO_2 requirements, 13289
chloralhydrate, effects as anesthetic on tilapia, 13255
chlorbutol, effects as anesthetic on tilapia, 13255
DDT, foof chain model for kinetics in freshwater marsh, 13263
environments, experimental-, light-control apparatus for, 13215
herbicides, effects on water and inhabitants, 13368
immunization against furunculosis, antigenicity testing of vaccine, 13298
insecticide-resistant fish, possible selective mechanisms in development of, 13366
insecticides, interactions affecting residue storage in rainbow trout, 13378
melanophore responses,
reflectance method for measurement, 13370
in teleosts, continuous recording of, 13375
MS-222, effects as anesthetic on tilapia, 13255
pentachlorophenol determination in organic tissues and water, 13399
polychlorinated biphenyls solubilized by surfactants for toxicity studies, 13390
propoxate, effects as anesthetic on tilapia, 13255
propylene phenoxetol, effects as anesthetic on tilapia, 13255
quinaldine, effects as anesthetic on tilapia, 13255
reclamation of waters with piscicides, FAO review, 13130
salmon, Atlantic, Salmon Research Trust of Ireland, Inc., 13458
serology, serum antibodies, goldfish, effects of cold storage, 13308
spermiation of goldfish as bioassay for salmon gonadotropin, 13396
structures, artificial-, for attracting coastal pelagic fishes, 13181
toxaphene, analysis in waters, fish, sediments by gas chromatography, 13400
toxicity of pesticides to fathead minnow in presence of LAS, 13372
urethane, effects as anesthetic on tilapia, 13255

River,
benthos, differences above and below impoundment, 13116
Columbia, spawning areas and abundance of salmonids, 13196
Don, USSR, physiology and biochemistry of pikeperch females, 13467
Elbe, Germany, differences in clupeid larvae, 13433
English rivers, water quality and absence of fish, 13397
fish populations, differences above and below impoundment, 13117
Green, Etheostoma barbouri, new darter from, 13248
Kamchatka-, USSR, morphology and variability of Arctic char, 13462
Kings, California, occurrence of chinook salmon, 13321
Miramichi, growth rate of Atlantic salmon between Greenland and home waters, 13445
Platte, Michigan, effect of coho spawning on benthos, 13122
Potomac, upper, diatoms and algae re power-plant discharge, 13288
Sagavanirktok-, drainage, Alaska, Arctic char differences, 13129
Saskatchewan-, DDT, DDE and DDD residues in fish re blackfly control, 13125

Sampling,
bass, striped, evaluation of gonadal biopsy from tag returns, 13256
benthos, quantitative artificial substrate sampler, 13251
capture of lake trout alevins, Lake Heney, Quebec, 13377
catch of Pacific Ocean perch, techniques and intensity required, 13282
creel,
census data, actual vs. reported fishing time as factor, 13311
survey, reservoirs, recommended method of reporting, 13457
fish samples and year-class strength, 1965-67, Canton Reservoir, Oklahoma, 13318
fishes, Woods Hole, Massachusetts area, numbers and lengths by season, 13198
gillnetting, winter-, radio telemetry for ice jigger location, 13307
larvae, fish-, kinds and abundance in eastern tropical Pacific, 13159
marine fishes of Virginia's eastern shore, 13238
sampler, free-vehicle-, bottom-water-, 13436

Specific,
albacore, 13383, 13388, 13389
alewife, 13430
anchovy,
bay, 13432
Black Sea, 13464
northern, 13447
striped, 13257
ballyhoo, 13187
bass,
largemouth, 13173, 13302
striped, 13256, 13286, 13297, 13323, 13465
Benibuna, 13270
bluegill, 13169, 13171, 13173, 13177, 13296, 13322, 13398, 13472
bream,
blue, 13137
red, sea, 13268
sea, 13233, 13265
white, 13149
bullhead, brown, 13313, 13414
capelin, 13341
carp, 13141, 13204, 13214, 13216, 13219, 13220, 13223, 13225, 13228, 13233, 13235, 13258, 13266, 13268, 13272, 13276, 13279, 13300, 13363, 13357, 13435, 13452, 13455
grass, 13435
silver, 13147, 13435
carp-bream, 13455
catfish, 13119, 13136, 13141
blue, 13319
white, 13414
char, Arctic, 13129, 13462
chub,
hornyhead, 13117
river, 13117
cisco, 13392
Clarias lazera, 13239
cobia, 13250
cod, 13348, 13393
Coryphaenoides acrolepis, 13431
crappie,
black, 13173
white, 13291
croaker, Gulf, 13162

Specific, cont.
dace,
blacknose, 13334
longnose, 13334
drum,
freshwater, 13200
red, 13257
eel, 13209, 13211, 13233, 13269, 13273, 13276, 13277, 13434, 13442
American, 13237, 13329
European, 13182, 13184, 13329
Etheostoma,
barbouri, 13248
obeyense, 13248
virgatum, 13248
flounder,
winter, 13353
yellowtail, 13345, 13438
Gadus callarias, 13275
goby, toad, 13133
goldfish, 13218, 13270, 13308, 13342, 13356, 13396, 13418
gourami, blue, 13118
grayling,
Arctic, 13294
Baikal, black, 13143, 13456
grouper, giant, 13242
grunion, 13327
guppy, 13402, 13442
hake, Pacific, 13336
halfbeak, 13187
herring, 13191
Atlantic, thread, 13257
horse-mackerel, 13464
ice-goby, 13210
jacksmelt, 13408
jenny, silver, 13257
killifish, plains, 13448
Konosirus punctatus, 13271
ladyfish, 13257
lamprey, 13210
American, brook, 13254
chestnut, 13254
northern, brook, 13254
silver, 13254
Lateolabrax japonicus, 13224
Lebistes reticulatus, 13190
Leuciscus cephalus, 13412
mackerel, jack, 13230
marlin, 13387
blue, 13387
white, 13387
Metapenaeus joyneri, 13271
minnow,
bluntnose, 13117
fathead, 13253, 13356, 13372
sheepshead, 13385
mojarra, striped, 13257
mosquitofish, 13371
mullet, 13464
Caspian, grey, 13359
striped, 13187, 13271
mummichog, 13167, 13236, 13338, 13407

Specific, cont.
Notropis,
gibbsi, 13249
trichroistius, 13249
Oplegnathus, 13276
Oryzias latipes, 13232
paddlefish, 13415
Pagrus major, 13271
perch,
European, 13138, 13156, 13392
Pacific Ocean, 13282, 13290
silver, 13257
white, 13167
yellow, 13426
pike, northern, 13141, 13177, 13405, 13411, 13423
pikeperch, European, 13392, 13455, 13467
Pimelometopon pulchrum, 13431
pinfish, 13257
pompano, 13410
pupfish, desert, 13161
quillback, 13174
roach, European, 13185, 13455
ruff, 13392
salmon, 13160, 13280, 13453
Atlantic, 13135, 13151, 13154, 13373, 13403, 13445, 13458
Caspian, 13140
chinook, 13153, 13193, 13197, 13295, 13321, 13367, 13382, 13404, 13416
chum, 13206, 13340, 13466
coho, 13122, 13193, 13196, 13281, 13285, 13326, 13352
kokanee, 13325
pink, 13340, 13466
silver, 13316
sockeye, 13126, 13188, 13196, 13340, 13346, 13347, 13382, 13394
sailfish, 13259, 13387
sardine,
scaled, 13181, 13257, 13432
Spanish, 13181
scad, 13181
sculpin,
coastrange, 13197
prickly, 13197
reticulate, 13197
shorthorn, 13335
torrent, 13197
seatrout, 13360
Sebastes,
aleutianus, 13343
caenaematicus, 13343
melanostomus, 13343
Sebasticus marmoratus, 13226
Seriola quinqueradiata, 13224, 13227, 13274, 13275
shad, 13244
American, 13306
threadfin, 13180
yellowfin, 13257
shark, 13267
shiner,
golden, 13349, 13356
spotfin, 13117
silverside, Atlantic, 13238

Specific, cont.
snapper, gray, 13413
snook, 13262
sole,
lined, 13257
petrale, 13284
spot, 13409
sprat, 13391
stickleback, 13350
fourspine, 13201
twospine, 13202
Stizostedion, 13287
sturgeon, 13132, 13139, 13415
Caspian, 13139
sucker, white, 13417
sunfish, 13199
longear, 13261
pumpkinseed, 13261
surmullet, 13464
swordfish, 13115, 13387
tench, 13141
Tilapia, 13247
hornorum, 13337
melanopleura, 13337
mossambica, 13148, 13255, 13337
zillii, 13165, 13337
timucu, 13187
Trachurus japonicus, 13271
trout, 13178, 13310, 13449, 13453
brook, 13373, 13429, 13450, 13451
brown, 13164, 13463
cutthroat, 13127, 13175, 13176, 13179, 13189, 13316, 13326
lake, 13121, 13377
rainbow, 13158, 13189, 13194, 13233, 13240, 13241, 13243, 13276, 13298, 13301, 13315, 13316, 13326, 13351, 13378, 13382, 13386, 13395, 13401, 13406, 13408, 13428, 13438, 13442, 13446
steelhead, 13193, 13196, 13281, 13320, 13382
tuna, 13252
bigeye, 13389
bluefin, 13389
Pacific, bigeye, 13388
skipjack, 13152, 13389
southern, bluefin, 13389
yellowfin, 13389
walleye, 13292
warmouth, 13173
whitefish, 13439
mountain, 13126

Stocking,
acclimatization of fishes in Bratskoe Reservoir, USSR, results, 13355
catfish, blue, introduction into California, 13319
prophylactic measures in stocking new fishes in waters, 13381
trout,
cutthroat, in Munsel Lake, Oregon, evaluation, 13179
rainbow, four strains in Beardsley Reservoir, California, comparison, 13315

Survival,
anchovy, northern, larvae, effect of food density, 13447
bass, striped,
evaluation of gonadal biopsy from tag returns, 13256

Survival, cont.
bass, striped, cont.
fingerlings, toxicity of nine therapeutants and pesticides, 13297
bluegill, effect of paraquat, Colorado farm pond, 13296
Clarias lazera, without air breathing, 13239
fish, toxic effects of trace organics, 13205
herbicides, effects on water and inhabitants, 13368
larvae of Black Sea fishes, re food supply, 13134
Lebistes reticulatus, used for demonstrating toxic substances, 13190
minnow, sheepshead, sensitivity of three generations to pesticides, 13385
salmon, juvenile, thermal tolerance re nitrogen supersaturation, 13193
salmonids, juvenile, effects of aerial spraying of sumithion, 13373
sharks, captured, lactate acidosis as cause of mortality, 13267
toxicity,
acute, NTA to fry and crustaceans, 13442
chronic, malathion to bluegill, 13398
LAS to bluegill, influencing factors, 13169
pesticides to fathead minnow in presence of LAS, 13372
PMA and metoxyethylmercuric chloride to Oryzias latipes, 13232
trout,
lake, in Lake Superior before 1950, 13121
rainbow,
effects of gamma radiation and sodium halides, 13194
resistance to temperature variation re thermal pollution, 13401
winterkill-, variability in yellow perch, 13426

Vegetation,
aquatic, plastic barrier for spot treatment, 13304
Chara, controlled with paraquat, effect on bluegill, 13296
Elodea preferred by stickleback over Potamogeton for habitat, 13201
kelp, drifting, fishes associated with, southern California, 13317

Virology,
device for removing fish embryo from egg, re viral multiplication study, 13123
sockeye salmon virus, species specificity and cytopathology in salmonid cells, 13382
virus in Sacramento River Chinook Disease, 13367

Abstracters other than authors and staff:

Selected Water Resources Abstracts

☆ U.S. GOVERNMENT PRINTING OFFICE : 1971 O—429-200

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of this department of natural resources.

The Department works to assure the wisest choice in managing all our resources so that each shall make its full contribution to a better United States now and in the future.

A CENTURY OF
FEDERAL FISH CONSERVATION